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TABLE OF CONTENTS.

Page

DEFINITIONS 570
GENERAL REGULATIONS 572

INFANTRY.

GENERAL RULES 575

SCHOOL OF THE SQUAD.

Individual instruction without arms 576
Position of attention 576
The rests 577
To dismiss the squad 577
Facings 577
Salute with the hand 577
Setting up (eighteen exercises) 578
The steps 582
Close order 584
To form the squad 585
Alignments 585
Marchings 586
Turnings 588
Manual of arms 589
The firings 597
Bayonet exercise 602

SCHOOL OF THE COMPANY.

Posts of officers, petty officers, and field music 607
To form the company 608
Alignments 609
To open ranks 609
To close ranks 609
To dismiss the company 610
General rules 610
To form column of fours and march by the flank 610
To change direction 611
To march to the front in column of fours 611
To change the file closers from one flank to the other 612
To march to the rear 612
To form line from column of fours 612
Column of twos 613
Movements by sections 613
Route step 617
To march at ease 617

SCHOOL OF THE BATTALION.

Page

Formation of the battalion 618
The color guard 618
Posts of officers and petty officers 618
Post of the band and field music 619
To form the battalion 619
To open ranks 621
To close ranks 621
To fire by company 622
The rests 622
To dismiss the battalion 622
To march in line 622
To march the battalion to the rear 623
To align the battalion 623
To give the battalion a general alignment 623
To pass obstacles 624
To form column of fours by the flank 624
To change the file closers from one flank to the other 624
To form line to the right or left 624
General rules for successive formations 624
To form front into line 625
To form column of companies to the right or left, and halt 625
To form column of companies without halting 625
To march in column of companies 625
To change direction in column of companies 626
To put the column in march and change direction at the same time 626
To form the column of companies to the right or left into line 626
To form front into line from column of companies 626
To change front 627
To advance in line of columns 627
To change direction in line of columns 627
To form line from line of columns 627
To form front into line of columns from column of fours 627
Marching in line of columns, to march in column of companies to the right or left 628
To march in line of columns to the right or left from column of companies 628
Marching in column of fours, to march in line of columns to the right or left, and march again in column of fours 628
From column of companies, to form column of fours, and to form again in column of companies 628
Advancing in line of columns, to close or extend intervals 628
In line of columns, to close or extend intervals without gaining ground to the front 629
Formation in close column 629
In close column, to take full distance 629

SCHOOL OF THE BATTALION—*continued.* Page
From line, to ploy into close column 630
In close column, to form column of fours 630
To march in close column 631
To deploy the close column 631
Movements by section 631
To march in route step and at ease 631

EVOLUTIONS OF THE BRIGADE.
General rules 632
Posts of the pioneers and band 632
Posts of the chief of brigade and staff 633
To advance in line 633
To give a general alignment to the brigade 633
To form in two lines to the right or left from column of fours 633
General rules for successive formations 634
To form on the right or left into line from column 634
To form front into line from column 634
To form front into line, in two lines, from column 634

EXTENDED ORDER.

GENERAL PRINCIPLES 635

SCHOOL OF THE SQUAD.
General rules 636
To deploy as skirmishers 636
To increase or diminish intervals between skirmishers 636
Marchings 637
To rally and deploy 637
The assembly 637
Rules for firing 637
Firings 638
Instruction on varied ground 639
Use of cover 640
Battle exercises 641

SCHOOL OF THE COMPANY.
Line of squads 642
From line, to form line of squads 642
From column of fours, to form line of squads 643
In line of squads, to deploy as skirmishers 643
From line, to deploy the company as skirmishers 643
To increase or diminish intervals between squads 643
To assemble 643
Marchings, in line of squads or skirmishers 644
To change direction in line of squads 644
To deploy by sections 644
Firings 644
To fire volleys by section or squad 644

SCHOOL OF THE COMPANY—*continued.* Page

To reinforce the firing line 645
To rally 645
Battle formation 645
Positions and duties of officers 646
The company in battalion on the offensive 646
Relieving the firing line 648
The company acting independently, offensive 648
The company in battalion on the defensive 648
The company acting independently, defensive 649
Action against cavalry 649
Defense and attack of artillery 650

SCHOOL OF THE BATTALION.

Deployment 650
The advance 651
Assemblying and rallying 651
General rules 651
The battalion in brigade, offensive 652
The battalion acting independently, offensive 653
The battalion in brigade, defensive 653
The battalion acting independently, defensive 654
The battalion as advance guard of a brigade 655
The battalion as rear guard of a brigade 655
Defense and attack of artillery 656
Night operations 656

THE BRIGADE IN BATTLE FORMATION 657

FORMATION FOR STREET RIOTS.

General rules 657
To protect the flanks 658
To form battalion square 658
Marching in column of companies, to protect flanks at street crossings, 659
To reform the company in column 659
From column of sections, to form company square 659
Marching in company square, to form for clearing a street 660
To form line from formation for clearing a street 660
From company square, to form column of sections 660
From company square, to form line 661
Artillery 661

CEREMONIES.

Dress parade of a battalion 661
Undress parade 664
Review of a battalion 665
Inspection of a battalion 668
Dress parade of a brigade 670
Guard mounting 672

ARTILLERY.

Page

General Rules 678

School of the Section.

To sling and unsling arms for dragmen 679
To form the crew 680
To form crew to the front, drag being manned 680
To man the drag, from crew to the front 680
To form crew to the rear, drag being manned 681
To man the drag, from crew to the rear 681
To prepare the piece for action to the front 681
To prepare the piece for action to the rear 682
Special duties of numbers when in battery, 3-inch B. L. R. 682
Special duties of numbers when in battery, 1-pounder Hotchkiss 684
Special duties of numbers when in battery, Gatling 685
To form crew to the rear when in battery 686
To resume stations in battery, from crew to the rear 686
To secure the piece when in battery 686
To man the drag when in battery 686
To fire to the rear, right, or left when in battery 687
To march to the front or to the rear 687
To move the piece a short distance to the rear 687
To halt 687
The rests 687
To change direction 688
To make a slight change of direction 688
To ascend or descend a steep incline 688
Disabled wheel 688
To dismount the piece 688
To mount the piece 689
To disable the piece 690
To disperse the crew, and to assemble 690
To dismiss the section 690
Service of the piece in boats, 3-inch B. L. R. 691
Service of the piece in boats, 1-pounder Hotchkiss 692
Service of the piece in boats, Gatling 693
Disembarkation of the piece, 3-inch B. L. R. 694
Disembarkation of the piece, 1-pounder Hotchkiss 694
Disembarkation of the piece, Gatling 695

School of the Battery.

General rules 696
Posts of officers and petty officers in line 696
Posts of officers and petty officers in column 697
Posts of officers and petty officers in battery 697
To form the battery 697
To align the battery 697

SCHOOL OF THE BATTERY—*continued.* Page

To form crews to the front 698
To form column of sections to the right or left 698
To form column of platoons to the right or left 698
To march to the front in column of sections from line 698
To march to the front in column of platoons from line 699
To put the column of sections in march and change direction 699
To put the column of platoons in march and change direction 699
To make a slight change of direction 700
To form column of platoons from column of sections 700
To form column of sections from column of platoons 700
To halt the column and put it in march 701
The about 701
To oblique 701
To resume the direct march 702
To close or extend intervals and distances 702
To march by the flank 702
From column, to form line to the front, right, or left 703
From line, to change direction 703
Passage of obstacles 703
From line, to form in battery 703
To change the fire to the right or left by the front or rear 704
To change the fire to the right or left on the center 704
To fire by section, platoon, or battery 704
To form echelon to the front or rear 705
From echelon, to form line to the front or rear 706
Route marches 706
To rest the battery 707
To dismiss the battery 707

INSPECTION OF A BATTERY 707

SCHOOL OF THE BATTALION.

General rules 708
Posts of officers, petty officers, and field music in line 709
Posts of officers, petty officers, and field music in column 709
To form the battalion 710
The color guard 711
To align the battalion, or give it a general alignment 712
To march in line 713
To close or extend intervals between batteries in line 713
To close or extend intervals between the sections of a battalion in line 713
From line, to form column of batteries to the right or left 714
From line, to march to the front in column of batteries 714
To put the column of batteries in march and change direction 714
From column, to form line to the right or left 715
From column, to form on the right or left into line 715
From column, to form line to the front 715

SCHOOL OF THE BATTALION—*continued.* Page
Echelon 716
To dismiss the battalion 717
REVIEW OF A BATTALION 717

MANUAL OF THE SWORD 720
COLOR SALUTE 722
INSTRUCTIONS FOR THE DRUM MAJOR 722
SIGNALS 724
HONORS 724
BUGLE SIGNALS 726

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CONTENTS.

PRIZE ESSAY FOR 1891. THE ENLISTMENT, TRAINING, AND ORGANIZATION OF CREWS FOR OUR NEW SHIPS. By Ensign A. P. Niblack, U. S. N., ... 3

NOTES ON AN EXPERIMENTAL AMMUNITION CART, CONSTRUCTED FOR THE ORDNANCE DEPARTMENT. By Lieutenant W. W. Kimball, U. S. N., ... 51

SIACCI'S BALLISTIC EQUATIONS. By Prof. Wm. Woolsey Johnson, U. S. Naval Academy, ... 57

ON THE ANGLE OF ELEVATION IN ORDER THAT THE TRAJECTORY IN AIR SHALL PASS THROUGH A GIVEN POINT. By Prof. Wm. Woolsey Johnson, U. S. Naval Academy, ... 61

TARGET PRACTICE. By Lieutenent J. F. Meigs, U. S. N. With Discussion, ... 67

Lieutenant J. C. WILSON, U. S. N., 82.—Lieutenant W. F. FULLAM, U. S. N., 83.—Lieutenant KOSSUTH NILES, U. S. N., 87.—Commander C. M. CHESTER, U. S. N., 87.—Captain L. A. BEARDSLEE, U. S. N., 89.

ELECTRICAL COUNTER, AND SHAFT REVOLUTION AND DIRECTION INDICATOR. By W. D. Weaver, Assistant Engineer, U. S. N., . . . 91

PROFESSIONAL NOTES, ... 95

The Organization and Duties of Trial Boards for our new Cruisers.

REVIEWS, ... 99

BIBLIOGRAPHIC NOTES, ... 100

PRIZE ESSAY NOTICE.

ADVERTISEMENTS.

NOTICE.

It has been deemed advisable to print the Prize Essay at once in the present number of the Proceedings, and to publish the discussions thereon in the next number, in order to allow ample time and full opportunity for the preparation of criticisms or remarks.

It is earnestly desired that all MSS. of discussions be forwarded to the Secretary and Treasurer not later than May 20th, 1891.

By direction of the Board of Control.

H. G. DRESEL, *Ensign, U. S. Navy,*
Secretary and Treasurer.

ANNAPOLIS, MD., *February* 13, 1891.

Having carefully read the five essays submitted in competition for the prize offered by the Institute for the year 1891, we have the honor to announce that, in accordance with Section 2, Article XI, of the Constitution, the prize is awarded to the essay bearing the motto "A man's a man for a' that," by Ensign A. P. Niblack, U. S. Navy.

Honorable mention is accorded to the essay bearing the motto "Occasionem cognosce," by Lieutenant R. C. Smith, U. S. Navy.

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THE PROCEEDINGS

OF THE

UNITED STATES NAVAL INSTITUTE.

Vol. XVII., No. 1. 1891. Whole No. 57.

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PRIZE ESSAY FOR 1891.

Motto:—"A man's a man for a' that."

THE ENLISTMENT, TRAINING, AND ORGANIZATION OF CREWS FOR OUR NEW SHIPS.

BY ENSIGN A. P. NIBLACK, U. S. Navy.

The Navy offers at present a respectable and inviting career to only a few enlisted men, and to those only in such special ratings as ship's writer, yeoman, printer, master-at-arms, and machinist. Petty officer's billets of the seaman class are thoroughly unattractive, and are filled throughout the service to-day by men who, however efficient they may be as seamen, have had very little modern training in the theory and practice of gunnery, have seldom been entrusted with the handling or drilling of a squad of men, and have very little idea of their duties and responsibilities as petty officers in a military sense. This is more the fault, however, of imperfect enlistment laws and defective methods of organization and training, than of any lack of intelligence or capability on the part of the petty officers themselves.

A modern ship, being a complicated machine, requires the most intelligent kind of men to handle and fight her effectively. On account of the cramped living space, the number of men on each new ship must be reduced to the lowest margin. Each man being thus a most valuable unit, we must proceed on the theory of picking our men and building up a trained nucleus of American men-of-wars-men,

capable of meeting the demands that will necessarily be made upon each individual in our organization in case the service is suddenly expanded to meet the exigencies of war. With the improved type of enlisted men now demanded by modern conditions, we need new Watch, Quarter, and Station bills, adapted to modern and improved types of cruisers and battle-ships. To man and fight these ships effectively, we need better methods of recruiting and training.

The holding out of a more attractive career to enlisted men is not so much a question of increased pay and emoluments as we would like to believe, nor are their shortcomings due as much to want of intelligence on their part as to the lack of military purpose in their training. Aside from this and from the evils in the system of rating, promotion and rewards, there are positive faults in the internal arrangements of our newer ships which will neutralize the allurements of any pay-table that can reasonably be devised, and in the end drive out of the service the very class of men and boys that we are now so earnestly endeavoring to attract into it. The more modern the ship and the greater the need for intelligence in her crew, the more and more objectionable she seems to become in point of quarters for the men, until we have about reached the point where it is well to call a halt on certain disastrous tendencies in the direction of the utter disregard of what intelligent men are capable of putting up with. In the smaller cruisers, flesh and blood will not stand any further sacrifice to illusive offensive power, particularly in the craze for phenomenal speed and great battery power on small displacement. Before taking up the consideration of the problems of recruiting, training, and organization, it will be best to point out some changes which are needed in the internal arrangements and discipline of our ships, in order to secure the creature comforts to the men under all conditions of service, and thus render the ships habitable and attractive.

New Ships and Old Methods.

There is not a new steel ship built or designed for the navy since 1884 that can carry her full complement of men as intended, or that has berthing arrangements and general accommodations which intelligent men have a right to expect. Fortunately we give much more attention to such matters than they do in foreign services, but that is no reason why we should stop half-way. In the Chicago, Boston, Atlanta, and Dolphin, designed before 1884, the berthing accommodations are not so bad. On the Chicago, which seems to be the only gun-deck ship we are to have, the hammock-hooks are 14 inches

apart, and the men swing "high and low." The rows of hammocks dovetail in with those forward and abaft them, and this, the usual arrangement, represents luxury compared to the newer ships. The Boston and Atlanta have fair quarters in the superstructure, but, commencing with the Yorktown, we find nothing but evil in the living accommodations of the men. In the last named, below the spar-deck, there are billets for twenty men in the bow compartments, for forty-four on the berth-deck, for twenty-two in the passageways, and for five in the alcoves and workshop. At sea, in any weather, the heat is almost intolerable, and on long passages the berth-deck is barely habitable. The men who sleep under the forecastle are not so badly off. On the Philadelphia and Baltimore it was found necessary at the Navy Yard, New York, to put up hammock-hooks in every available compartment on the protective decks, to accommodate even the reduced complement which each carries. The Charleston is admitted to be a failure in her original berthing arrangements, but it is only fair to state that the last four ships mentioned are built more or less on English models. The tendency of our own constructors and their attitude is shown by the following extract from the report of the Chief Constructor for 1889, relative to the two 3000-ton cruisers, Cincinnati and Raleigh, building at New York and Norfolk respectively:

"The forward berth-deck, with the exception of the paymaster's office, dispensary and prison, is given up to the crew. There are also roomy quarters for the men under the forecastle."

It is a good thing that the forward berth-deck is surrendered to the men, for in the roomy space under the forecastle are located the galley, crew's water-closets, the distiller, ice-machine, refrigerators, the steam capstan, vegetable lockers, scuttle-butt, bitts, harness cask, and hawser reels. This type of ship, begun in the Yorktown, is the general style of all the newer ones with uncovered gun-deck. On the Philadelphia, with an unusually "roomy" forecastle as far as dimensions go, only eighteen men can billet under the forecastle. What can we look for in cruisers Nos. 9, 10 and 11, of 2000 tons displacement, where the design calls for water-closets, crew's wash-room, the brig, capstan, galley, ice-machine, refrigerators, engineer's workshop, hawser reels, bitts, etc., under the forecastle? This, of course, means that the crew-berths are entirely below the spar-deck. In port in a cool climate, with an inspection board pronouncing on the fitness of such ships for distant and prolonged service as cruisers, the air-ports are not closed, the ice-machine is not rattling away, the blower engines are not humming, the ash-hoists are not buzzing, the

dynamos are interesting, and the distiller is temporarily out of use. Put all these in the living spaces, add the phenomenal heat of modern fire-rooms, and the noise, oily smell, cramped berthing space, bad air, and consequent loss of sleep, and the picture is that of ordinary cruising at sea. Prolong this for months and it means sickness, discomfort, and inefficiency of the crew. The remedies for all this are simple enough.

1st. Group as far as practicable all heat-producing objects and auxiliary engines, such as blowers, dynamos, galley, ice-machine, distillers, etc., in one compartment, or in adjacent compartments, as remote as possible from living spaces, with carefully arranged separate ventilation.

2d. Substitute electric motors for all auxiliary engines doing constant work in or about living spaces and that cannot be grouped as above.

This is only, in a measure, forestalling the inevitable substitution of electric for auxiliary steam power. Aside from saving miles of piping, with the inevitable leaks and the expensive water-tight joints at each bulkhead that is pierced, there are the additional advantages in the less danger of having the supply cut off in action, and of compartments flooded with steam; in the reduction in heating and oily smell all over the ship; in being able to use motors for ammunition-hoists, thereby reducing the need for so many men in the powder division; in economy of power over present arrangements; in ability to splice a break readily; in the ease with which the wires at vital points can be protected with steel tubing; and finally, in the reduction of the engineer's force by the number of men now required to look out for auxiliary engines, and the substitution of seaman-gunners to run the motors, thereby increasing the number of trained combatants on board by that many.

3d. Reduce the ship's complement of men and officers to a minimum, especially in small ships.

The necessity for a certain amount of entertainment by the officers in time of peace calls for a considerable table space in a mess-room, which should be, where practicable, separate from the living space, and it should be made a regulation that all commissioned officers, below the commanding officer, shall constitute one mess. In the smaller ships of 2000 tons and under, junior and warrant officers' quarters should be abolished, and if the exigencies of the service really require the assignment of one or more cadets, they also should mess in the ward-room. In larger ships the necessities for

reduction in officers' quarters are not so great, but still the tendency must be towards "surrendering" to the men more living room, even in the best of them.

4th. In smaller ships already built or designed, add a light spar-deck, worked over the space between the poop and forecastle, to give additional berthing space.

If the weights do not admit of adding the covered deck, then do away with the auxiliary sail-power, which is of less importance than the comfort and efficiency of the crew. The best plan is to stop designing, and sending people to sea in small vessels of enormous horse-power. It is a delusion and a snare to attempt to get high speed on small displacement in cruising vessels, and expect to beguile intelligent Americans into accepting, as a profession, life in such sweat-boxes, with no place to stow clothes, and with every unsanitary condition carefully observed. There is almost a criminal side to the case in the sacrifice of safety to speed in these so-called cruisers. In the Yorktown, which has not phenomenal speed, a double bottom was not possible. In the extremes of the type, like the Serpent, we have a lesson that we should not be slow to learn. The tendency is too much towards sheet-iron shells, light steel frames, and linoleum bulkheads as they have abroad in such so-called cruisers as the French Forbin, where only conscription can keep a crew in her. The physical condition of the men, when it comes to action or to conditions of war, is of greater moment than the one or two knots extra about the twenties for which we are asked to sacrifice so much. Great speed is all right on great displacement, and is all wrong in small vessels really intended as cruisers.

More stowage room should be provided on board ship for the men's clothing and outfit. Each man is required to have the following, valued at a total of $56.35:

2 suits of blue	$12.36	1 white hat	$ .33
2 white mustering suits	5.32	1 neckerchief	1.06
3 white working suits	3.18	1 pair leggings	.60
2 blue undershirts	2.58	1 pair blankets	4.36
2 pairs drawers	2.30	1 mattress with covers	4.32
2 pairs socks	.66	1 suit oil-skins	2.20
1 pea-coat	10.00	1 pair rubber boots	2.50
2 pairs shoes	2.28		
2 caps (one mustering)	1.80		$56.35
1 watch cap	.50		

This simply represents what a man requires to be presentable under the conditions of service. Many men have four or five working suits, white hats, etc., and they certainly ought to be encouraged to dress well; but, for instance, on the Chicago the average capacity of the forty-four wire lockers in which the same number of apprentices are required to stow all their belongings is 1.8 cubic feet. The other men have lockers of about 2.2 cubic feet average capacity, but the engineer's force are allowed an extra locker each for soiled clothes. Considering that this ship is the roomiest and most comfortable of the new ships, the first-class petty officers, who usually wear white shirts, collars, cuffs, etc., should have more than 3.7 cubic feet for their clothing. The result is that rain-clothes are stored where they deteriorate rapidly, pea-jackets are lashed in the hammocks, the clothing all shows the result of tight packing, the locker doors are sprung, and a premium is placed on shiftlessness. In the newer ships the lockers are larger, but from four to six cubic feet is reasonable. Separate lockers should be provided for rain-clothes, with pigeon-hole subdivisions capable of holding a pair of boots, southwester and oil-skins, to be stored by gun's crews, with a separate locker or two for those watch petty officers who require them. Oil-skins of the prescribed pattern should be kept in the paymaster's stores for issue, for it is useless to attempt to have a boat's crew in uniform, a thing which is desirable and easily enough accomplished if properly looked out for. Living out in all kinds of weather, oil-skins are certainly an essential part of a man's outfit; and, as they are prescribed as a uniform, some official attempt should be made to protect the men from the harassing unreasonableness of requiring them to have everything of a uniform pattern and then providing no place to stow the things they are required to have. It is such policy as this that drives more men out of the service than questions of life career, more pay, or seamen's savings banks, etc. Ditty boxes are part of men's outfit, yet few ships go into commission with any racks provided for their stowage. The holds of ships are now so small that a great deal of the gear formerly stored there, such as deck-buckets, stages, wash-deck gear, boat-gripes, sea-painters, stage-ropes, etc., are crowded out. Places must be provided for these, as well as for cleaning-gear for brightwork; gun, hatch, canopy, steering wheel, binnacle, search light, and other covers; boat cushions and cloths; watch-tackles, straps, heaving-lines, lashings, old canvas, steaming-covers, etc., which are required to be

handy for routine purposes. Top-chests and channel-chests cannot be carried now, yet there is no allowance to take their place. The regular allowance for ships should include deck-chests, boatswain's mates' chests, and spar-deck lockers for the stowage of gear that is in more or less constant use. Neglect to provide proper stowage-room leads to tendencies on the part of the men to surreptitiously stow gear in ventilators, guns, field carriage boxes, air ducts, capstan barrels, hammock nettings, wash-rooms, and all the nooks which supply the lucky bag with its daily haul. There is nothing so time-honored as a lucky bag, and yet few ships have any place provided for its stowage.

The ordinary conditions of cruising bring out, of course, many defects which cannot be foreseen, but there are many things which an inspection board should be charged with ascertaining, which are considered trivial, but which make the difference between a happy and an unhappy ship.

Proper drying-rooms for clothing should be provided, particularly for the engineer's force. Standing, as they do, in three watches, there is no such thing at sea as a chance to wash clothes in the morning watch, and opportunities should be given them at other times. With practically mastless ships, the facilities for drying clothes for all hands are not what they should be, and it would be of immense advantage to have a large drying-room to be used in bad weather, care being taken to locate it apart from the living space of the men, on account of the heat it gives out.

In a sanitary way men have very little idea of the question of the proper ventilation of a ship. Improved appliances are useless unless properly looked out for. So much depends on it now-a-days that it seems worth while to provide blowers that will work either way, so as to force or exhaust as required. The direction of the wind in steaming forms draughts through a ship independent of the currents set up mechanically, and differences of temperature come somewhat into play. It thus happens that a certain compartment of the ship may, under certain circumstances, require both a force and an exhaust draught to clear it of foul air, while, under others, it would have to have the forced or exhaust system only. If it is worth the expense of putting in the elaborate appliances now provided, it is certainly worth the while of some one to look after the subject carefully. This will be spoken of later.

In thus calling attention to the necessity for providing increased

comforts for the men and for improving the sanitary condition of ships in the matter of berthing and ventilation, it is aimed to lay down the proposition that it is the small annoyances in life which make the difference between happy and unhappy ships; but there is one other thing which is more important than even this, or than the question of increased pay and emoluments for faithful service, and that is the administration of firm and even-handed justice. An idea is prevalent that the discipline in our navy is very harsh, and, like most popular ideas, is founded on the glaring exceptions which prove the other rule. Fact is that, through one cause or another, the general system of punishment has been so relaxed that for certain offenses there is now no adequate punishment, which, coupled with the entire lack of uniformity throughout the service, earnestly calls for an inquiry into the subject by a board of officers with a view to tautening up the whole system. Plenty of work, many privileges and comforts, and rigid adherence to fixed, swift and well-graded punishments, means good discipline and hence general contentment. In each new ship designed the brig is given a more and more choice location, until in cruisers 9, 10 and 11 it is under the forecastle in the 6-inch gun support. The fundamental principles of confinement in a brig are restraint and removal from intercourse with others, and solitary confinement becomes a farce when the prisoner can constantly see his messmates passing to and fro, and where the noise and bustle of the ship's routine work is interesting and diverting to the prisoner. The light is generally good, the ventilation is excellent, and the confinement admits of rest and recreation. If the brigs were put below, where they were intended to go, and were kept dark and isolated from all noise and intercourse with the crew, then five days' solitary confinement would mean something. Non-intercourse, restraint, and silence are the very elements of solitary confinement, and its purpose is defeated in the new ships. In the Philadelphia and Baltimore there are small brigs—one on each side of the berth-deck in the 6-inch gun supports. To properly enforce a sentence of bread and water there should be a sentry on each brig, as they are separated by a fire-room trunk. This means eight sentries to properly enforce the sentence of two men. The Yorktown's brig is under the forecastle. That of the Chicago is on the berth-deck forward, where people are constantly passing to and fro. The punishment of double irons is now no punishment at all. Not only do the hand and leg irons now furnished ships admit of the greatest freedom

of motion, but such confinement becomes a rather welcome opportunity for the idle, lazy and shiftless to escape work for five days or so. The messmates of the prisoner do his work for him while he eats the bread of idleness, and dozes away his time. To be a punishment, confinement in irons should primarily imply retirement from the public gaze, and should be made as irksome and uninviting as possible. What is needed is the old-fashioned leg-iron with sliding-rod through staples in the deck, and lilly-irons for the wrists. In the interests of good discipline and in economy of sentries, the brig should be located below the berth-deck, away from the temptation and opportunities of the men to pass in food; it should be as remote from the noise and bustle of active life as possible; it should be well ventilated but not lighted; and, in the passageway outside of it, leg-irons should be fitted to the deck as described above for prisoners confined in irons as a punishment. The present style of irons is admirable for the confinement of men for safe-keeping, but it is manifestly unfair to treat a man awaiting trial or sentence of a court-martial to the same punishment as a man confined in irons for an offense of which he has been adjudged guilty. The man awaiting trial may be acquitted as innocent, yet he is punished the same as the man adjudged guilty of some minor offense. There should be a wide distinction. With proper fittings in a ship for punishing men, and with certain and unvarying punishment for specific offenses, with additional penalties for repeated infractions of the same regulation, it is possible to carry out the purpose and spirit of the navy regulations. The whole subject needs investigation and revision by proper authority, and it is just as important as questions of increased pay and rewards.

In nothing so much as in the messing arrangements on board ship is there more pressing necessity for a radical change. The interests of the service demand the establishment of a general commissary system, in place of the antiquated, uneconomical, and cumbersome mess organization which we now have. Under any other arrangement than that which now obtains on board sea-going ships the ration of thirty cents a day would be ample, and the usual assessment of from $1.50 to $3 per month in addition, which the caterers of messes exact from each member, represents the correct measure of the wastefulness, poor economy, and failure of the present system. To exact such sums of money from apprentices getting $9 or $11 per month, or from landsmen getting $16, is nothing short of out-

rageous. Nor is this in any way the fault of the men themselves, but simply demonstrates that the separate mess system is fundamentally wrong. To illustrate its workings let us examine into details. Each mess consists of from eighteen to twenty-three members, some more, some less. Each has its separate cook, caterer, vegetable-locker, mess-locker and mess outfit. In the mess outfit the government furnishes a coffee, tea and sugar-tin, molasses and vinegar-breaker, a scouse-kettle, bread-kid and a mess-cloth. Each mess buys in addition a coffee-kettle, knife, salt and pepper-boxes, carving-knife and fork, knives, forks, spoons, coffee-tins, plates, butter-dish, oil table-cloth, meat-dishes, frying-pan, and three baking-pans. The rations as issued and the fresh provisions, not perishable, are stored in tins, boxes, etc., in the mess-lockers. Each mess has its slop-buckets, dish-pans, swabs, etc., for cleaning gear. Multiply each outfit by the number of messes; crowd the cooks around a galley; see the lack of economy in space, the wastefulness in food, and the character of the cooking; see the liability to confusion, difficulties and conflicting interests that must bring constant trouble, and then try and find one good reason for continuing a system that stamps itself on its own face as a monumental failure. There are always difficulties in getting men who are willing to serve as cooks; they must be paid extra money by the messes; confusion reigns when a cook is absent on liberty, or sick, or confined as a punishment; caterers abscond now and then with the mess funds; and finally, the berth-deck cook is an unmitigated nuisance in the ship's organization that causes more difficulties than any other class of men in the ship's company. The remedy for all this is simple enough.

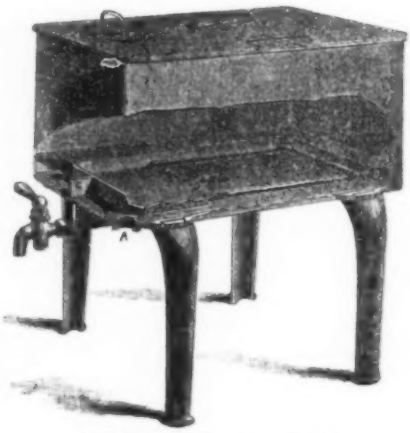
Abolish separate messes; cook the issued rations as for one large mess; with the commuted ration-money purchase such extras as with the fresh provisions issued by the pay department in port will insure good living, reserving, however, some of the money as a sea-store fund; set aside a separate compartment or enclosed space as a pantry, containing lockers and racks for storing the general mess-gear, the stores for immediate use, and the various appliances and gear needed in the preparation of food for cooking; locate here, also, sinks with hot and cold fresh and salt water, with hand and steam-pump connections for washing mess-gear; merge all the vegetable lockers into one general system of lockers; and finally, set aside a store-room and a space in the hold for the men's provisions and

stores. The rate of baker, abolished in 1883, should be revived, and those of ship's steward, pantryman, messman and ship's cook's assistant created. The pay of steward should depend on the class or rate of the ship, but should be, at least, from $75 to $100 per month. He should be a man of experience as a caterer and the very best man that can be gotten for the money. He should select and order mess supplies, and render bills to be paid in such way as will insure the safety of mess money, or the protection of the mess against loss by any method of fraud or dishonesty. The whole messing arrangements should, however, be under the supervision of an officer whose function will hereafter be described. The ship's cook should be required to qualify as such at a naval rendezvous before transfer to a sea-going ship, and for thus qualifying should receive increased pay. It should be the duty of the pantryman to receive and have charge of all stores, mess-gear, etc., in immediate use, and, assisted by the assistant ship's cook and such messmen as may be needed, to prepare the food in the pantry ready for cooking. It should be the duty of the baker, under the direction of the pantryman, to prepare and bake all bread and pastry. It should be the duty of the assistant ship's cook to assist the pantryman in the preparation of food, and the cook in such ways as may be necessary. It should be the duty of the messmen to wash all mess-gear, spread mess-tables, help in the preparation of food, clear up, clean and keep in order the pantry and store-rooms, and in every way assist the pantryman, baker and cook in their duties. It is confidently believed that eight messmen could do the work now done by eighteen cooks, or that six or seven could do that of from twelve to sixteen, being a clear gain to the effective deck force of at least fifty per cent. The ship's steward could certainly do the work of all the mess caterers not only more economically, but with better judgment and intelligence. The ship's cook, his assistant, and the baker could cook or bake all that is required by a general mess much better than the ship's cook can now alone cook for some sixteen separate messes. As for the pantryman, the gain in economy and in time in the preparation of food for a general mess, as contrasted with the go-as-you-please style of preparing all sorts of dishes for a number of messes, is too apparent to need practical demonstration. The number of messmen could be reduced to the lowest limit by having a certain number of men detailed for a week at a time to go below when mess-gear is piped, to help set and serve tables from the galley or pantry. After meals

they could help clear off the tables and sling them overhead. Such services would not be required for more than from fifteen to twenty minutes altogether, and need not in any way interfere with their duties on deck. The ship's company should mess by gun's-crews or divisions as now, excepting that apprentices should be organized into separate messes presided over by first or second class petty officers. Men going on watch should all be served at the same table, thereby saving over the present arrangement of having half a dozen tables or mess-cloths going for half an hour before each meal. Petty officers' messes could very easily be furnished with extra dishes through extra money paid into the mess fund, provided they wished to live better than the regular mess. This general system here outlined is, with some necessary modifications, carried on for the cadets on the practice cruise, and is entirely feasible. On the receiving-ship Independence at Mare Island it was inaugurated several years ago by Captain Frederick Rodgers, U. S. N., under the supervision of the executive officer, Lieutenant Daniel Delehanty, U. S. N., and was described in the Naval Institute Proceedings about that time. It certainly commends itself on every possible ground, and it is worth at least a trial on a sea-going ship.

In the latest types of ships, cold storage and refrigerating rooms are provided. These add very much to the efficiency of the ships in the ability it gives them to carry fresh provisions for long periods of time at sea, thereby reducing the necessity for such large store-rooms below, and adding to the healthfulness and comfort of the crew. It would certainly add to the efficiency of all ships now in commission, to put in cold storage rooms as a compensation for the reduction in store-room and hold space for the stowage of provisions. Cruisers 9, 10 and 11 will be fitted with Allen's dense air ice and refrigerating machine, capable of making 200 pounds of ice a day, and of cooling a 60-gallon scuttle-butt, besides keeping a meat-room of 350 cubic feet at a temperature below 34° F. It is a sufficient commentary on our present system of having numerous messes, to point out that with twelve to eighteen different cooks running to a cold storage room to get out from twelve to eighteen different pieces of meat, with the consequent confusion and the admission of hot air to the room, the cold storage would be apt to prove a failure. With a general mess and a large cold storage room there is no reason why fresh provisions should not be carried for thirty days as in ocean steamers.

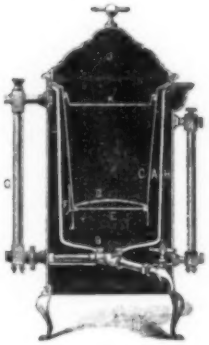
Meat, Vegetable, or Soup Boiler



Inside View, Showing Workings

Coffee, Tea and Hot Water Urns

Roasting Oven



Inside View of Urn

The liberality of the present ration, the extra dishes prepared, the provisions purchased with commuted ration-money and by extra assessments, the issue of fresh provisions in the pay department, all lead to overcrowding the galleys now furnished ships, and bring failure upon any type of range that can be adopted. There are many pertinent reasons for abolishing the present type of galley. The work required of one can best be performed by steam heat. In all modern ships it is required that steam be kept up constantly on an auxiliary boiler for the various purposes of electric lighting, distilling, heating, pumping, etc. All roasting and boiling in large quantities is best and most economically accomplished by using steam heat. The steam roasting ovens and boilers are perfect in their operation, convenient for shipboard, and possess every advantage over a range. As for the self-feeding copper urns for making coffee and tea, nothing can more highly commend itself to our consideration. The present method of making coffee is for the berth-deck cook to drop an uncertain amount of ground coffee into a big tin bucket and pour a still more uncertain amount of hot water in with it. The water may or may not be boiling, but that is hardly material. The coffee steeps for ten or twenty minutes, and the result is an insipid drink in which a great amount of excellent coffee has literally gone to pot. In the steam self-feeding urns, on the contrary, the coffee is made on the drip principle, and the water feeds in automatically. Unless the coffee water is actually boiling, it will not feed over into the urn. A sketch of such an apparatus is shown in Plate I, where the centre urn is for hot water and the end ones for tea or coffee. They can, of course, be made any size collectively or relatively. The operation of the coffee urn is shown in a section in the same plate. The drip-basket, C, in which the coffee or tea is placed, is made of copper. The bottom, D, is pierced with small holes, while below it is the flannel strainer, E, which can easily be replaced. The cast-iron vegetable boiler is also shown in section. The live steam enters at A and passes around to B, being cut off by the partition C; E is a galvanized iron steam-pipe, perforated for steaming purposes; G is the strainer and outlet to the faucet. Galvanized iron baskets go in the boilers to separate different things that may be boiling at the same time, such as meats and vegetables. A small steam oven could also be provided for keeping warm the meals of men away at meal hours.

For baking bread or pastry, a sheet-iron bake-oven, burning coke

or coal, should be provided. It would only be needed for a few hours in the day, and requires very little fuel. With such an oven and any sort of a baker there would be no need for buying fresh bread on shore in any of the officers' or men's messes.

For a crew of 450 men, a galley or range of the present type furnished with all the accessories costs fully $1500. For $1200 the following outfit, as shown in Plate II, can be placed in the same amount of space as now occupied by a regular galley :

5 oblong seamless cast-iron steam roasting ovens with hinged covers, each 24 inches by 33 inches, at $75	$375
3 seamless cast-iron steam vegetable, stew, meat, or soup boilers, of 70 gallons capacity, with galvanized iron hinged covers, at $75 each	225
One set of self-feeding copper urns on iron stands, with gauges, faucets, strainers, etc., complete, of the following sizes: water urn, 100 gallons; coffee urn, 80 gallons; tea urn, 40 gallons	400
One sheet-iron bake-oven, 3 feet square, with three compartments	200
Total	$1200

The roasting ovens and boilers should be lagged with asbestos to prevent radiation and to keep down the temperature of the galley space in hot climates. The above outfit would easily go in a space twelve feet by ten, with ample room to get around in. Whether it is used for a general mess or a separate mess system, the advantages of this outfit over the galley or range may be stated as follows:

1. To "start fires" requires turning on a valve or so, and in twenty minutes the plant is in full operation.

2. If desired, only a part of the plant need be operated on occasions when it is desired to practice economy.

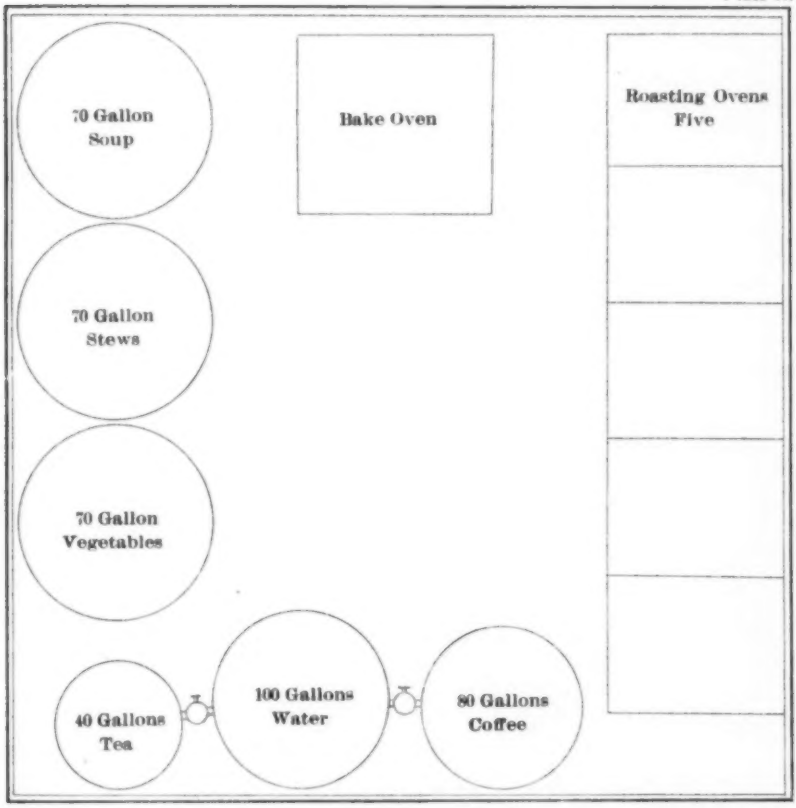
3. The heat given off by such a plant in the tropics is much less than by a galley, and the noise about it is very much less.

4. The oddest kind of shaped space can be utilized for erecting such a plant, as remote from living spaces as possible, on account of ability to fit any shaped space to order.

5. No immense and expensive bed-plate is required as in the case of a galley.

6. The danger from fire is reduced to a minimum.

Plate II.



Scale ½″ = 1′

STEAM PLANT FOR MAN-OF-WAR'S GALLEY.

In space 12 ft. x 12 ft.

FOR CREW OF 560 MEN.

7. Cooking by steam gives the best results in a culinary way, and is more economical than burning coal in a range.

8. Once set up, a steam plant will outlast several galleys, as there is little to get out of order, and can be replaced in part as it wears out.

9. Steam cooking plants are in successful operation at the general recruiting depot of the army at David's Island, at Snug Harbor, and, to a certain extent, in all the leading hotels in New York City.

The following named people are a few of the firms which are prepared to make bids on erecting such a plant in whole or in part on different men-of-war: John Ashcroft, No. 73 Gold street, New York; Duparquet, Huot and Moneuse Co., No. 43 Wooster street, New York; Bramhall, Deane & Co., No. 274 Front street, New York; Van & Co., Cincinnati, Ohio.

This system of messing should be supplemented by a co-operative bumboat system on the canteen principle. The profits of bumboating are enormous, and should properly accrue to the men themselves. The economy of buying fruit, beer, etc., by wholesale instead of by retail is a sufficient argument for undertaking such a system, at least in large ships.

The general commissary and canteen system here briefly outlined is perfectly feasible and certainly desirable. The more minute details will in a measure work themselves out in practice if the idea is once adopted in the service.

In thus looking out for the physical comforts and welfare of the men there need be no fear of coddling them. There is too much routine work for every one aboard a modern ship to admit of men being spoiled, in the ever-recurring necessity of overhauling, cleaning, painting, scraping, and caring for the hull and armament of a cruiser or battle-ship. The chief difficulty is to find sufficient time to devote to drills and exercises without neglecting too much of that attention to smart appearance which has always characterized the vessels of the American Navy.

Recruiting.

Having called attention to several needed improvements in the internal organization, arrangements, and discipline of our new ships as affecting the comfort and best interests of the men, it is well to now inquire into what special inducements we should offer, in the shape of rewards and emoluments, as will not only attract into the service more of the better class of Americans, but retain them in the

navy for life. This we can only accomplish by excluding aliens from the service, and by offering to the men advantages and rewards as substantial relatively as those which officers now receive, and equal to those offered by corresponding occupations in civil life. We have in the service now, (1) a practically working continuous-service system, providing a small longevity increase of pay for each three years of service; (2) a system of conduct grades with corresponding monthly money allowance; (3) improved rations far better than issued in any other service in the world; (4) a good quality of clothing of more or less uniform pattern, and small stores in variety and at the lowest market prices; (5) a government savings system paying 4 per cent interest on money deposited; (6) two pension laws, one providing help from the Naval Pension Fund for disability after ten years' service, on recommendation and finding of a board of officers, and the other providing a regular pension, or, in lieu of it, maintenance at the Naval Home, for disability after twenty years' service; (7) a fairly good apprentice system; (8) an allowance of $45 to apprentices on enlistment for clothing; and (9) a system of instruction for seaman-gunners which is not yet, but soon will be, in thorough working order. These represent, outside of the pay tables, the principal inducements now held out to enlisted men to make a career in the navy. The results are not encouraging. It is not that we do not get many good, bright, excellent men, but that we do not seem to be able to retain them in the service longer than one or two enlistments. To endeavor to remedy this, and to supplement what has already been done towards making a life career for men in the service, the following provisions should be enacted by law:

I. No alien should be accepted for either special or continuous service, excepting to fill vacancies in special service billets for the remainder of a cruise on a foreign station.

In the matter of restricting all enlistments to Americans, some difficulties may seem to present themselves in the case of getting men for certain special service billets, such as stewards, cooks, servants, and bandsmen. Fact is, it is in these billets that we most of all need Americans. The day has passed when foreign messmen and bandsmen can be relegated to the powder division. The question of the rapid supply of ammunition is serious enough without complicating it with thoroughly non-combatant foreigners, unused to manual labor and ignorant of our language. If we cannot get

American servants for the pay allowed, then it will be time enough to increase the pay. If we cannot get American bandsmen for the same reason, let us put up with inferior music. As each non-effective man in a ship takes up as much room as an effective one, and as few ships can carry their effective complement, it certainly follows that in the matter of messmen and bandsmen we have a long way to go to arrive at a satisfactory solution of the problem. Once pass the law and the difficulties will in time vanish. The exception noted above, in the filling of vacancies in special service billets abroad by foreigners, is a necessary one. As for general and continuous-service men, there can be no doubt as to the wisdom of restricting enlistment to Americans, or to those who have declared their intention of becoming naturalized, as it is the height of folly for a rich and powerful nation to have to rely on mercenaries and hirelings in the exigencies of war, through neglecting in time of peace to train up a picked body of her own citizens to bear arms for the national defense.

II. Unless having had previous naval experience, no men other than effective, able-bodied men, between the ages of eighteen and thirty-five, shall be enlisted.

III. The term of enlistment shall be for a period of four years.

Section 1418 of the Revised Statutes, enacted as far back as 1837, provides that men "may be enlisted to serve for a period of not exceeding five years, unless sooner discharged by direction of the President." Three years has come to be the customary service, and the laws relating to continuous service (Rev. Stat. 1426 and 1573) have been enacted on a three years' basis. This change to four years will require corresponding changes in the laws relating to honorable discharges, allowances for re-enlistment, and increase of pay for each re-enlistment. A four years' enlistment will enable ships to make full three-year cruises without having to pay so much extra compensation to men held over after expiration of enlistments, and, best of all, will permit of recruits being put through some preliminary training at recruiting stations before they are drafted off to cruising ships. Such modifications of the present continuous-service laws as are needed are outlined in IV, V, VI and VII, which follow.

IV. Every person re-enlisting for a period of four years within a period of four months after having been honorably discharged, shall, on presenting his honorable discharge, or on accounting in a satisfactory manner for its loss, be entitled to pay during the said four

months, equal to that to which he would have been entitled had he been employed in actual service.

V. Every person who, having been honorably discharged from the navy, re-enlists within four months thereafter for a period of four years, shall be further entitled, after four years' service, including his first enlistment, to receive, for the period of four years next thereafter, two dollars per month in addition to the ordinary pay of his rating; and for each successive period of four years of service, so long as he shall remain continuously in the navy, a further sum of one dollar per month; the past continuous service of enlisted men now in the navy, not to exceed four years, shall be taken into account, and shall entitle such men to additional pay according to this rule. *Provided* that one dollar per month shall be retained from the pay of the re-enlisted men, of whatever rating, during the whole period of their re-enlistment, to be paid to each man on his discharge, but to be forfeited unless he shall have served honestly and faithfully to the date of discharge.

VI. To the rates of pay which may from time to time be fixed upon by the President, there shall be added, (1) in the case of men enlisted for a period of not less than four years, for the third year of enlistment one dollar per month, and two dollars per month for the fourth year; and (2) to the rates of pay so fixed in the case of apprentices and boys, enlisted to serve until they shall arrive at the age of twenty-four years, there shall be added for the second year of such enlistment, after they shall have attained the age of twenty-one years, one dollar per month, and two dollars per month for the last year of such enlistment. But this increase in every case shall be considered as retained pay, and shall not be paid to such enlisted person until his discharge from the service, and shall be forfeited unless he serves honestly and faithfully to the date of his discharge.

VII. Continuous-service men shall be entitled to one month's leave for each year of service, to be granted at the convenience of the Navy Department, and to be cumulative up to four months, which may, however, be commuted in whole or in part on re-enlistment, if leave is not desired, to cash payment of four months' pay, or in accordance with amount of leave surrendered. A continuous-service man thus entitled to leave may, if he so elect, report on board any convenient receiving-ship or any recruiting station, and, under such rules as may hereafter be prescribed by the Navy Department, may enjoy his leave of absence, with privilege of residence on board such

ship, or at such recruiting station, in the quarters provided for enlisted men.

VIII. Boys between the ages of fourteen and eighteen shall hereafter be enlisted to serve until they shall arrive at the age of twenty-four, instead of twenty-one as now provided.

IX. Any apprentice serving in either a training or a sea-going ship may, at any time in the first three years of his enlistment, on the finding of a board of three officers, be discharged for inaptitude or undesirability for the service, but due notice shall be given the parent or guardian of such apprentice, at the expiration of which time, with the approval of the Navy Department, said apprentice shall be transferred to the nearest receiving-ship and there discharged. The discharge of an apprentice for any cause before he shall reach the age of twenty-four, shall work forfeiture of the $45 originally received for outfit. Notification of the vacancy at any time created shall be promptly sent to the commandant of the Apprentice Training Station, in order that the total complement of apprentices shall be kept full.

X. In the appointment of warrant officers, preference shall hereafter be given to graduated apprentices who, after having reached majority, shall have served at least two years as a seaman, petty officer, or special class petty officer on a sea-going ship, and shall have subsequently qualified as a seaman-gunner.

XI. All enlisted men serving in the Coast Survey and Fish Commission shall be called in by executive order, and authority granted these services to enlist their own men for their own purposes.

Under section 4397 of the Revised Statutes, "The heads of the several executive departments shall cause to be rendered all necessary and practicable aid to the Commissioner (of Fish and Fisheries) in the prosecution of his investigation and inquiries." The navy practically furnishes the steamers of the Fish Commission with their men and officers. That it is not "practicable" now to longer spare this force from the naval service is sufficient grounds for the withdrawal of it. That such service is of no military benefit to the enlisted men is certain. That the men in it are a dead loss to the navy as men-of-wars-men is of necessity a good reason for calling them into active military service. Under section 4685 of the Revised Statutes, "The President is authorized .... to employ all persons in the land or naval service of the United States" to carry out the provisions of the acts establishing the Coast Survey service; and under section 4687,

"Officers of the Army and Navy shall, as far as practicable, be employed in the work of surveying the coast of the United States, whenever and in the manner required by the Department having charge thereof." This is subserving the military to the civil branch of the government with a vengeance. The fact that the army has dropped out of any share of the work under the Coast Survey, and that the navy bears most of the drudgery and a large share of the annual expense of the hydrographic work, is not in itself a hardship, but from a military point of view it represents a grave mistake. Untrained merchant and coasting sailors are the class of men from which the crews of Coast Survey vessels are recruited, and they are well adapted to such service. That so many man-of-war petty officers and seamen are diverted from a military service where they are absolutely needed, into a non-military service to furnish it with the means of doing the only work for which it was originally created and now has any nautical claims for existence (viz., surveying the coast) is, to say the least, a queer state of affairs. The annual appropriation for the support of the Coast and Geodetic Survey is over a half-million dollars, of which sum about $50,000 is for the expenses of hydrographic work carried on by some ten or more vessels manned and officered from the navy, and about $25,000 for the maintenance and repairs of these vessels. The annual appropriation for the publication of charts representing this hydrographic work, of so much value to mariners, is less than $20,000. In other words, less than one-fifth of the total appropriation goes to do the work for which this branch of the government was organized, and for which it gets the credit with the country at large. The merchant marine is benefitted by all this superb work, and the annual appropriations for the support of the Coast and Geodetic Survey are cheerfully granted. How many people in the United States know that the navy with its officers and men do the work, and that it pays annually some $200,000 for the salaries of the sixty officers and the men diverted from military service to do this work for a civil branch of the government? This service undoubtedly enables the naval officers in it to become familiar with our coast and harbors, and a moderate amount of duty in the Coast Survey service may possibly be of great value, but for enlisted men, drawn from an already depleted allowance, such diversion is unjust to the navy, uneconomical, unmilitary, and unnecessary. The sooner the enlisted men are called in, the sooner a grave mistake will be rectified.

XII. The total number of persons who may at one time be enlisted in the navy shall not exceed 10,000, of whom 1500 shall be apprentices and boys.

XIII. When an enlisted man absents himself from his ship on the eve of her sailing for a foreign port, and then gives himself up as a "straggler" on board some receiving or other ship, he shall forfeit three months' pay, and be further required to serve three months beyond the regular expiration of his enlistment, before he can acquire the right of discharge and the benefits of continuous service in case of re-enlistment.

XIV. Whenever it is discovered that a person who has been dishonorably discharged from the navy has eluded detection and re-enlisted, he shall be immediately discharged in the nearest available port, at home or abroad, and forfeit all pay that may be due him on the books, excepting $10 for immediate expenses.

XV. The Navy Yard, New York, shall be designated as the Central Recruiting Station for the Atlantic Coast, and the Navy Yard, Mare Island, on the Pacific Coast. All recruits enlisted on either coast at the various other recruiting stations now or hereafter established shall be concentrated, as hereafter provided for, at these two central stations, for instruction and preliminary training before drafting them off for service.

The ordinary receiving ships at different points should serve merely as conveniently distributed posts for recruiting under special conditions. At stated intervals a transport should make the rounds and gather in recruits, concentrating them at New York for inspection and training, leaving, however, the continuous-service men on the various receiving-ships, for such disposition as the bureau may see fit. This system of inspecting recruits at the central stations would lead to the detection of deserters and dishonorably discharged men who might try to enlist. There shall be attached to the stations at New York and Mare Island a corps of experienced and trained petty officers, rated in such billets as master-at-arms, yeomen, and gun-captains, constituting a body of what may be termed recruiting and drill sergeants, and composed of men who had made excellent records in the service on sea-going ships as petty officers. While gaining valuable experience in drilling and handling men, they would aid in examining and keeping records of recruits and would become personally acquainted with them. By this means and by a good system of descriptive lists, in the course of a short period of years,

it would be almost impossible for a deserter or dishonorably discharged man to escape detection on presenting himself at or on being transferred to New York or Mare Island. By changing a few commissioned and petty officers occasionally between New York and Mare Island, it would not only contribute to uniformity in duties and methods at the two stations, but would lessen the possibility of such men as described changing their base of operations from one coast to the other. It is notorious that men now desert and re-enlist, or are dishonorably discharged and come right back into the service by re-shipping at remote stations, and this evil should be put down at once. Let men once understand that dishonorable discharge and desertion mean severance with the service for good, and that deserters will be followed up and brought to justice wherever possible, and there will be a great falling off in both. By going even further and requiring men to bring certificates of good character when they present themselves for enlistment, and by raising the physical and mental standard in the requirements for enlistment, the good effect would be shown in fewer desertions. Make it harder to get in and recruits will not be so anxious to get out.

Coal-heavers and second-class firemen for the entire service should only be enlisted at New York, where a uniform and rigid standard should be established. There is no difficulty in getting plenty and the best at this one station. It is easy enough in case of a scarcity or extra demand to order special enlistment at other stations. The enlistment of coal-heavers on this coast is now confined to New York by recent orders, and the improvement in this class of men is most marked. Of course, continuous-service or honorably discharged coal-heavers and second-class firemen should be allowed to re-enlist at the nearest recruiting station. In Section XII it is sought to increase the total force of enlisted men to 10,000. This is admittedly more men than we need just at present for our ships, but to be able to keep a lot of men at New York or Mare Island for six months or so in training, it is necessary to increase the total allowance. Where the allowance is small, a sudden emergency might arise and a draft of recruits be ordered off, to the breaking up of any systematic attempt to drill them properly. With a larger total force, the pressure would never be so great as to call for raw recruits who had never received any instruction.

XVI. Any seaman or seaman-apprentice who shall hereafter qualify as a seaman-gunner, or any seaman who, having heretofore qualified

as a seaman-gunner, shall re-qualify by attaining excellence in small-arm and great-gun target practice, and shall be able, as a leading man aboard ship, to drill a squad of men in the usual routine drills, shall receive in any rating as a petty officer of the seaman class an increase of pay of 30 per cent over that provided in the regular pay tables, as authorized by the President from time to time for such rating, and in any rating of either the special or artificer class he shall receive an increase of 10 per cent.

This will have the double effect of encouraging men to become seaman-gunners, and of adding dignity and importance to billets of the seaman class. To further improve the status of the seaman class of petty officers, a considerable increase in their pay is both wise and desirable. This class of petty officers bear the brunt of the routine work about decks, of the military duties, and of the fighting in action, and on their efficiency largely depends the character of the discipline of the ship. It is through them that we must accomplish some needed reforms in the organization and general discipline of the service, yet these billets are now doubly unattractive through the drudgery of their work and the small pay and great responsibility of their position. This is so much the case that seaman-gunners and graduated apprentices generally try to get the billets of ship's writer, painter, oiler, or yeoman—anything, in fact, to keep out of a rating of the seaman class or as a watch petty officer. This is admittedly all wrong and a great misfortune to the service.

XVII. Cooks, stewards, servants, and ship messmen shall be enlisted for special service, and on board the ships in which they are to serve.

XVIII. Pensioners who become inmates of the Naval Home shall hereafter be paid their pensions under certain restrictions, to be held in trust by the Governor of the Home, or allotted to a wife, or child, or parent living.

The fact that a pensioner takes advantage of the privileges of the Naval Home is no reason why he should surrender his pension, particularly if there are others dependent on him.

XIX. Transportation at government expense shall be furnished, under the direction of the Secretary of the Navy, to such persons as may be authorized to enter the Naval Home as beneficiaries, and who shall be unable to pay for their transportation to the same.

XX. After thirty years' continuous service as an enlisted man or as an appointed petty officer in the navy, any person shall be entitled

to retirement on three-fourths pay of the rank or rating held by him at the date of retirement, by making application to the President; or, after having served thirty years, but not continuously, any person shall be entitled to retirement on half-pay. *Provided* also, as in case of enlisted men in the army and Marine Corps, under Act of September 30, 1890, active service, either as a volunteer or regular during the War of the Rebellion, shall be computed as double time in computing the thirty years necessary to entitle him to be retired.

XXI. Dishonorable discharge in any case shall work forfeiture of all subsequent benefits of pay, pension, or retirement due to previous honorable service.

XXII. Officers and enlisted men of the Marine Corps shall be withdrawn from service afloat, and serve as a garrison for naval stations and in the sea-coast defenses of the United States.

Section 1616 of the Revised Statutes reads: "Marines may be detached for service on board the armed vessels of the United States, and the President may detach and appoint for service on such vessels such of the officers of said corps as he may deem necessary." This would seem to imply that when no longer necessary they should be withdrawn. Section 1619 says: "The Marine Corps shall be liable to do duty in the forts and garrisons of the United States, on the sea-coast, or any other duty on shore as the President, at his discretion, may direct." It is certainly in keeping with the march of progress abroad to follow the example of foreign powers and place our sea-coast defenses in the hands of a semi-naval branch of the government. The record of the Marine Corps certainly merits the confidence of the country, and in taking this step we are but following out the dictates of wisdom in officering our sea-coast garrisons ultimately with graduates of the Naval Academy, and for the present with officers whose sea experience would be of the utmost value in the defense of our coast.

As to the wisdom of withdrawing the marines from service afloat, the subject has so recently been discussed that little argument is here necessary. If, however, no other arguments were forthcoming, it would be sufficient to show that it is demanded by the reduced complements of our recent ships. The newer vessels exact such care for their hull, armament, and machinery; the coaling of them is such a task, and the routine work required of the men is such that the marine "who toils not" takes up too much valuable room. The Yorktown has a guard of 18, the Baltimore and Philadelphia each

36, the Boston and Atlanta 40, and the Chicago 56. Of course some one has to do the police duty of a ship, and the marine does the work acceptably enough, but he is not sufficiently versatile. In a modern ship a man must be something more than a soldier; he must be a sailor besides, and a man with only one talent is out of place on a man-of-war. Aside from the desirability of having the police work done by the men themselves, it makes a ship's company more homogeneous, and is more in keeping with the system which requires our officers to perform a wider range of duties than any similar body of men in the world. Primarily this demands intelligence on the part of the individual, and, secondarily, thorough training in all the qualifications which make a modern man-of-warsman. In adopting this system for the men we are simply taking a step necessary to place our naval service at least theoretically ahead of any other in the world. There are other immediate reasons for the withdrawal of the marines from service afloat. The infusion into our men of a proper military spirit, now believed to be so necessary in modern training, is an impossibility as long as the marine guard exists on board ship. It is idle to say that we cannot trust the men themselves with police duty. If we cannot, then we have the strongest argument that can be advanced for beginning at once to remedy a defect that stamps any organization a failure in which the fighting force is untrustworthy. If we are to make any progress in increasing the respectability and sense of responsibility of enlisted men, we must take this step as a fundamental one. Such police duty is essentially military, and a proper spirit can never be cultivated in the men as long as the marine guard, by its mere presence on board ship, is a notice to the men that they are not trusted and respected; that they are incompetent to perform military duties, and that they do not possess the confidence of the officers. The military spirit is not difficult to acquire, particularly if exacted of men by the officers themselves. Most of the average marine guard sent on board a ship are raw recruits. One sees very few continuous-service stripes amongst them, and in the annual report for 1890 the number of re-enlistments is given as 85, while there were a total of 948 enlistments and 520 desertions, and this in a total force of 1950, with five years as a period of enlistment and with 918 of the total force serving on board ship.

A full marine guard of the newer ships will never in the future, even for a flagship, consist of more than forty men, of which one

will be orderly sergeant, two or three sergeants, four corporals, two music, and about thirty men. The detail in port consists usually of four admiral's and four cabin orderlies, and some three to five posts, each taking some four men, or about twenty in all. Then there are two cooks and a mail orderly. On gun-deck ships and the larger battleships there would be needed four corporals for the gun or battery deck, besides. In case the marine guard is withdrawn from service afloat, it is here proposed to perform their present duties in the ship as follows: We have now on board each ship a master-at-arms, a ship's bugler, and a ship's corporal, with an additional ship's corporal for a gun-deck ship. Add one more ship's bugler and four to six ship's corporals to the ship's complement. On flagships have in the commander-in-chief's complement an allowance of four men for flag orderlies. On flagships and other than flagships, select four men for cabin orderlies; these and the flag orderlies to serve for three months as such. Assign one man also to act as a mail orderly in port and as a sentry at sea. Select from four to six men as compartment men for the protective deck and lower compartments, to keep them clean, to preserve order, and to be responsible for them in every way, serving practically as sentries in the compartments to which they are assigned. They should have important duties in connection with closing water-tight doors, rigging hand-pumps, and opening or closing proper valves for fire or other purposes; regulating the ventilation under the general direction of an officer, whose functions will hereafter be described; and above all, in being held strictly responsible for the police of the compartments to which they are assigned. They should sleep there, and only leave it for "all hands." Assign the master-at-arms, corporals, orderlies, and compartment men to the Powder Division, and the two buglers to the Navigator's Division. Detail from the deck force each day a sufficient number of men to act as sentries for the three, four, or five posts which may be necessary, just as they do in the army, where sentry duty is legitimate military service. Aboard ship it might be well to make a detail last for a week at a time, but not longer. The master-at-arms and two corporals should make the rounds, and be on duty continuously from "all hands" in the morning, or from daylight, to 10 P. M., alternating in inspecting below, to suppress or report all infractions of the regulations. The master-at-arms should occupy the same relation to the entire force that the orderly sergeant does to the marine guard, excepting that his duties should be more active in policing the ship

and less in drilling the men under him. He would of course have also to do what constitutes his important duties at present as master-at-arms, excepting that with a general mess system he would have no berth-deck cooks to look after. The other three or four corporals should be on the spar-deck in port, to assist the officer of the deck, somewhat as a corporal or sergeant at the gangway does now, in overhauling boats and looking out for details of discipline, etc. For a quarterdeck guard in port where necessary, use as now certain men off post, with the addition of one or more machine-gun's crew from deck as needed, or detail a boat's crew from one of the boats that are hoisted, with the coxswain as sergeant or corporal of the guard.

XXIII. The following table gives the present monthly pay and ratings in the navy, and also the new ratings and new rates of pay here proposed. The new ratings are in italics, and the new rates of pay in the second columns. The old ratings to which stars are prefixed should be abolished. Any man holding a certificate as a seaman-gunner (having qualified in target firing or gunnery) shall be entitled to receive 30 per cent increase over any rate of pay shown in the proposed table for a petty officer's billet of the seaman class, and 10 per cent in a petty officer's billet of the special or artificer class.

With regard to certain new rates here proposed it may be well to make some explanation.

The rate of gun-captain should be established, and to qualify in it a man should be able to drill a squad of men at any regular routine drill, such as infantry, artillery, great guns, machine guns, etc.; should be required to pass an examination in the "duties of a gun-captain" as laid down in the hand-book hereafter mentioned; and should have made at four successive quarterly target practices a prescribed percentage hereafter fixed upon by the Navy Department. Gun-captains should rank as second-class petty officers of the seaman class. In case a man is rated as gun-captain without qualifying, he shall receive $35 a month. A gun-captain, qualified, shall receive $45 per month. The same explanation applies to ship's cooks and machinists. To qualify in those rates requires that the candidate shall have passed through the prescribed training at the central recruiting station as hereafter described.

The rates of electrician and dynamo-tenders seem to be demanded, as distinguishing them from the engineer's force in official designation.

SEAMAN CLASS.		
1st Class Petty Officers.	Present.	Proposed.
Chief Boatswain's Mate	$35	$50
Chief Quartermaster	35	50
Chief Gunner's Mate	35	50
2d Class Petty Officers.	Present.	Proposed.
Boatswain's Mates	$30	$35
Quartermasters	30	35
Gunner's Mates	30	35
Gun Captains		35
Gun Captains, Qualified		45
Coxswain to Com'd'r-in-Chief	35	35
3d Class Petty Officers.	Present.	Proposed.
*Captains of Forecastle	$30	
*Captains of Maintop	30	
*Captains of Foretop	30	

SPECIAL CLASS.		
1st Class Petty Officers.	Present.	Proposed.
Master-at-Arms	$65	$65
Equipment Yeoman	60	60
Apothecaries	60	60
Paymaster's Yeoman	60	60
Engineer's Yeoman	60	60
Ship's Writer	45	45
Schoolmaster	45	45
Bandmaster	52	52
Ship's Steward		100
2d Class Petty Officers.	Present.	Proposed.
Ship's Corporals	$28	$35
Ship's Cooks	35	35
Ship's Cooks, Qualified		45
Chief Musicians	36	
3d Class Petty Officers.	Present.	Proposed.
Captains of Hold	$30	$30

ARTIFICER CLASS.		
1st Class Petty Officers.	Present.	Proposed.
Machinist	$70	$70
Machinist, Qualified		80
Electrician		70
2d Class Petty Officers.	Present.	Proposed.
Boilermaker	$60	$60
Armorer	45	45
Carpenter's Mate	40	40
Blacksmith	60	60
Sailmaker's Mate	40	40
Water Tender	38	
Dynamo Tender		38
3d Class Petty Officers.	Present.	Proposed.
Printers	$40	$40
Painters	36	36
Oilers	36	36

*Captains of Mizzentop	30	
*Captains of Afterguard	27	
Coxswains	30	30
Quarter Gunners	27	27
Signalmen		27

Seamen, 1st Class.	Present.	Proposed.
Seaman Gunners	$26	$26
Seamen	24	24
Seaman Apprentice, 1st Class	24	24

Seamen, 1st Class.	Present.	Proposed.
*Lamplighters	$25	
Ship's Cook's Assistant	25	$25
Jack of Dust	22	22
Buglers	33	33
1st Class Musicians	32	32
Tailors	30	30
Barbers	30	30
Bakers		38

Seamen, 1st Class.	Present.	Proposed.
Firemen, 1st Class	$35	$35
*Carpenters	25	
*Caulkers	25	
Carpenters and Caulkers		30

Seamen, 2d Class.	Present.	Proposed.
Ordinary Seamen	$19	$19
Seaman Apprentices, 2d Class	19	19

Seamen, 2d Class.	Present.	Proposed.
Baymen	$18	$18
2d Class Musicians	30	30

Seamen, 2d Class.	Present.	Proposed.
Firemen, 2d Class	$30	$30

Seamen, 3d Class.	Present.	Proposed.
Landsmen	$16	$16
Apprentices, 1st Class	16	16
Apprentices, 2d Class	11	11
Apprentices, 3d Class	9	9
Boys	10	10

Seamen, 3d Class.	Present.	Proposed.
Messmen		$19

Seamen, 3d Class.	Present.	Proposed.
Coal Heavers	$22	$22

Our signal corps on board ship is inferior to what it should be. Something must be done to bring it up to a proper standard. It is proposed to establish the rate of signalman, with the pay of $27 per month; any ordinary seaman, seaman, or apprentice of corresponding rates being eligible, where specially fitted for the position. A hand-book for quartermasters and signalmen should be officially gotten up for their instruction and to prescribe the duties of quartermasters and signalmen, and the rating of quartermaster should be held out as an inducement to signalmen to become thoroughly proficient.

By the system of messing here proposed it is hoped to restore to the deck force at least 50 per cent of the berth-deck cooks now allowed. By having all commissioned officers (other than the commanding officers) in one mess, and by not assigning warrant officers and naval cadets to small ships, we can do away with warrant and junior officers' stewards, cooks and servants. By transferring the marine guard to a higher sphere of usefulness on shore we can largely increase the available working force on deck. The need of doing this in new ships with their crowded living spaces is sufficient warrant for hoping that sentiment will not stand in the way of common sense.

With increased pay, comforts and respectability, and with a fairly attractive career offered to enlisted men, we can hope to attract intelligent Americans into the navy. With more intelligent men we can secure a wider range of duties from each individual. With good raw material everything depends on training. The handling and fighting of a ship's armament is the true modern basis of the education and training of our men. We give too much importance to the paint-pot, holy-stone, active-topman type of man on the one hand, and leave all the military training to the marines. The modern effective unit, the seaman artillerist, must be somewhat of both types, and very much more than either, not only in military spirit and exactness, but in professional attainments to a degree not as yet fully realized. The improvement in the status of our men can and should end only in placing our service in harmony with the spirit and purposes of our republican institutions. This we can never do as long as we widen the gap between the officers and men by exacting the highest standard in the former and the very lowest in the latter. The new types of ships have done much to emphasize this, but we must train the men to the ship, not strive by conservatism to check

the development of the *matériel* simply because it involves radical changes in methods of training.

Training.

There is neither sufficient time nor room aboard the new ships, in the exigencies of cruising, to conduct the drilling of recruits systematically and thoroughly, particularly in the first few months of a commission when there are so many other things to be looked after. It would tend, moreover, to secure uniformity, continuity, and thoroughness in the preliminary training of men, and would result in the greater economy in time and labor, if certain drills, up to fixed standards of efficiency, were given recruits at the central recruiting stations at New York and Mare Island before drafting them off to cruising ships. The most serious faults to be contended with in our service to-day are: first, lack of homogeneity in the crews of ships; second, lack of uniformity in drills, routines, etc.; and third, the absence of a strictly military purpose in the training of men. The duties of commissioned and petty officers, and the routine and details of drills should be thoroughly systematized. What we need are hand-books on different drills, accessible to officers and men alike, and a series of short and condensed text-books outlining the duties of petty officers and what they should be required to know to qualify in the ratings they hold. In the French service such books are prepared under government supervision, and sold for a nominal sum to the men. One gives, for instance, instruction to quartermasters and signalmen and all that they ought to know to qualify in such ratings; another, instructions to quarter-gunners and gunners' mates, etc. The application of these books to the practical examination of candidates for ratings, or to men or boys advanced from one rating to another, would tend to secure uniformity in the qualifications for ratings throughout the service. At present it is largely a matter of the individual ship, and the qualifications demanded are un-uniform, vague, and not at all thorough, except in special cases.

At the central recruiting stations the preliminary training of recruits should include setting-up exercise, gymnastics, swimming, school of the soldier and company, pistol and cutlass drill, single-sticks, boxing, bayonet exercise, field artillery, machine-gun drill, aiming and pointing, knowledge of accounts with paymaster, sewing, care of clothing, and familiarity with routine naval and police duties. Enclosed pistol-ranges for target practice should be erected at New

York and Mare Island, and in the preliminary drill in aiming and pointing of small arms, air guns or parlor rifles should be used to illustrate the principles of aiming and firing. At Sandy Hook, near New York, and at the Mare Island Navy Yard, rifle ranges should be erected, embodying the latest ideas and suited to the requirements of individual, skirmish and company firings. Systematic firing over the ranges should be carried on until the men attain a fair ability to hit a target at various distances. Every endeavor should be made to familiarize the men with the care, preservation, and use of the arms they are called upon to handle aboard ship. The course of instruction at the station should last some three months or more, and should embrace from four to six hours a day.

Attached to the New York station should be four vessels to be used in the training of recruits. One should be a transport, to make the rounds of the recruiting stations at stated intervals, to gather in the recruits and to take drafts of men to ships along the North Atlantic coast. The second should be a small steamer of some sort, mounting a six-inch rifle, and having a small secondary battery consisting of a three- or six-pounder Hotchkiss, a revolving cannon, and a Gatling, to be used as a gunnery training ship for target practice for recruits at the station, to cruise out to sea or in Long Island Sound for a day or so at a time. The third should be either a sailing vessel, like the Saratoga, or a steamer with practically full sail power, like the Yantic, to serve as a training ship for recruits. From time to time recruits should be transferred to her for a cruise of from three to four months, for instruction in seamanship, alacrity, heaving the lead, signals, compass, log, knotting and splicing, handling boats, and the usual duties of a seaman as distinct from the military and gunnery duties of a man-of-wars-man. The incidental routine gunnery drills on board should be somewhat the same as at the station on shore, such as school of the soldier, small arms, machine-gun drill, single-sticks, field artillery, etc., to familiarize the men with the drills in service afloat. Great attention should be paid to boat drill as a most valuable professional exercise and a most necessary training for seafaring men. They should be taught to handle and bring boats alongside in all weather under oars or sail, and to expose themselves in bad weather in order to give them that confidence which only comes with a great deal of experience, and with a real knowledge of how to handle a boat under all conditions. They should be exercised in righting a capsized boat, in jumping overboard to pick up

other persons in the water, and in every way encouraged to that fearlessness which comes with trained courage rather than heedless daring. It is easy to exaggerate the virtues of the old system of training men aloft as compared with the really thorough, athletic and professional training which men can be given in ordinary ships' boats under intelligent guidance. It should be as important to train men to handle a boat as to train a cavalryman to ride a horse.

The fourth ship, more or less attached to the central training station at New York, should be some modern ship like the Miantonomah or Terror, for the training of the recruits for the engineer's force. A vessel of this kind, to have routine target practice, must needs put to sea each quarter anyway, and it is certainly of sufficient importance in the training of the engineer's recruits to justify frequent short trips to familiarize men with their duties. As all coal-heavers for the coast are enlisted at New York, and all second-class firemen should also be so enlisted, it follows that a regular course of training in steam engineering and preliminary military training should be established for such recruits. It should go even further. A school for machinists should be added, and all who qualify in it should receive the increased pay provided for qualified petty officers. There is quite as much, if not more call for improvement in the character and training of men in the engineer's force than in the deck force, and if we are wise we will wake up to an acknowledgment of the fact.

Another advantage of having thoroughly equipped recruiting stations at New York and Mare Island is in the ability to provide for drilling the naval reserve forces at stated periods.

With a large total allowance of 10,000 men in the service, there will be no difficulty in carrying out this scheme. With a small allowance it will be impossible, as unexpected demands will be made on the central station, and men drafted off with little or no training to meet emergencies that are always arising. There must be a wide margin to enable men to receive proper training. With regard to whether or not recruits in service on shore should live in barracks or on receiving-ships depends entirely on the efficiency of the ships, and whether or not they can accommodate as many men as may be necessary. The ships possess many advantages in respect to training, but in the course of time barracks will have to be built. In that case, the life of the recruit in barracks should be assimilated as nearly as possible to service conditions. This whole scheme of preliminary training is nothing more nor less than the application of the Apprentice Training System to general service recruits.

As regards the apprentice training system itself, special efforts must be made to enlarge and develop it. With the total allowance of apprentices increased to 1500, and an earnest effort made to retain the best products of the system in the service, it would become a most important factor in Americanizing the navy. Modern guns and appliances, and increased accommodations and facilities for training are very much needed. The attachment of the Richmond to the station is a great step in the right direction. The enlargement of the course for apprentices to qualify in special and artificer class ratings is demanded by new service conditions.

The seaman-gunners,of to-day are the poorest paid, most seriously discouraged, and yet the most important class of men in the navy. Right here must begin a new departure, as this class of men must form the keystone of our organization. Not only should as many men as possible be thoroughly trained as seaman-gunners, but the course of training should be constantly enlarged and improved, until our petty officers shall be, as far as possible, recruited from men who have first qualified in the rating of seaman-gunner.

The present custom is to send continuous-service men just after re-enlistment to the Navy Yard, Washington, to qualify in ordnance and gunnery, and to Newport to qualify in torpedoes and electricity. The applicant must be a seaman or petty officer of the line, under 32 years of age, and be able to read, write and cipher. He is also required to take out naturalization papers if not already a citizen of the United States. The course at Newport is very far from what it ought to be, and is irregular and unsystematic. The working force at the station is so small that the men are too often utilized for routine work for it to be profitable to the men in the way of general training. Certain men make a specialty of learning printing, others make torpedo fuzes and detonators, and still others run the electric plant. All this is valuable in its way, but the course, to be a course, must be uniform, thorough and systematic. More officers are needed at the station, or else a good deal of the training now given can be better accomplished at Washington in connection with the advance and gunnery course. Men frequently qualify at Newport who have had only a few hours' lecture on electricity and a most theoretical course in torpedoes. After the men are transferred to sea-going ships the present pay tables begin to cause mischief. One man gets the rating of machinist at $70 a month; three others become oilers and get $36; while others become gunners' mates at $30, armorers

at $45, printers at $40, yeomen at $60, and writers at $45. The pay of petty officers of the seaman class, from which these men are selected or recruited, is so much smaller than that of the special and artificer classes that the deck force receives little or no benefit from the seaman-gunner course. The past training has had the effect of fitting the men best for civil life, and the discouragement of the outlook in the service has operated to the effect of driving most of them out of the service at the expiration of their enlistments.

At the Washington Navy Yard great strides have been made towards the establishment of a proper school for seaman-gunners. With the target practice on board the Alarm with machine-guns and six-inch rifle, and the establishment of a rifle range on the Bellvue magazine reservation, we will soon have in the service a class of seaman-gunners who are, as they should be, expert artillerists. The standard should be high, and when a man qualifies he should receive largely increased pay, especially in ratings of the seaman class. The shops at the navy yard afford every facility for the mechanical and technical training needed, and the system of drills carried on by the seaman-gunners themselves, under supervision of commissioned officers, gives them the training they need as petty officers. The discipline is excellent and the results are very promising. The facilities should, however, be increased and the classes enlarged. The whole course of instruction of seaman-gunners needs thorough systematizing, and hand-books should be gotten out as soon as possible, to aid in the instruction not only of those at Washington and Newport, but those out in the service who need to freshen up from time to time and to keep up with the improvements and changes that are constantly being made.

The circulars of the Bureau of Navigation in relation to target practice, money prizes, etc., leave nothing to be desired in that respect excepting that they may be rigidly carried out in the service. The principal extension of this practical training in prize firing should now be in the application of the whole system to the apprentice training squadron and station, the central recruiting stations for recruits, and the seaman-gunner course at Washington. Special preliminary training both of recruits and petty officers, with a view to securing uniformity in the service and of freeing ship's routine of the elementary drills, is earnestly demanded by modern conditions.

Organization.

A consideration of the recent tendencies in naval construction leads inevitably to the conclusion that sail-power cannot play an important part in the navy of the future. With twin screws which do not uncouple and cannot trice up, the most we can look for is auxiliary sail for storm purposes. The Newark is the only square-rigged vessel of the more recent ships, and every tendency, as shown by the report of the Policy Board and the plans of vessels contracted for, is in the direction of restricting sail to a very limited area. The Squadron of Evolution, in its recent cruise of 16,000 miles, had every opportunity of testing the utility or futility of square sails, and a study of the logs of the ships will furnish no grounds for a return to the Brooklyn or Pensacola types of cruisers. It is not that sails are obsolete, or that the training of officers and men with spars and sails must be given up, but it is sacrificing too much to handicap swift cruisers with sail-power that is only an incumbrance. Officers and men should be trained aboard sailing ships or auxiliary steamers at the Naval Academy, Newport, and at the central training stations, but it is going backwards to put useless sails on swift cruisers for doubtful advantages in training that can be infinitely better accomplished on regular training ships. Strong, reliable and not too complicated engines, good accommodations for the men, strong hulls with double bottoms, handy and roomy coal-bunkers, increased ammunition capacity, and improved methods of handling the same—these are questions alongside of which the importance of the question of sail-power in a modern swift cruiser dwindles into insignificance. Indeed, in the matter of coaling ship we have a long way to go. The demand for water-tight compartments and the continuity of the armored deck lead not only to most unhandy coal-bunker arrangements, but to difficulties in getting out coal fast enough to maintain high speeds for considerable runs, and, most important of all, to utter inability to coal ships in anything like reasonable time. The spectacle of a swift cruiser like the Philadelphia or Baltimore taking some three or four days to coal, or even one day, is in itself startling. If those last quarters of knots of speed which are added for cases of emergency are worth to the country $50,000 each, at what are we to value the hours wasted through absurd coaling arrangements at a critical juncture, when each hour means a loss of 18 knots or so underway? Fact is, in any new organization we must frankly come to it that the coal-bunkers and the means of filling them demand a

place in our new station bills under the heading "Coaling Ship," just as "Making Sail" or "Reefing" were of importance in the past. The coal-shovel, the ammunition-whip, and the lock-string must all have live men on the ends of them, and alacrity is just as great a factor as it ever was in naval discipline and efficiency—some think greater.

Probably nothing can show more clearly the tendency of modern ships in the reduction of living space than the following comparison of the complements of the Chicago and Philadelphia, each representing epochs in naval development, and each carrying a crew up to the full limit of her berthing capacity. The full complement of the Chicago is 442, and of the Philadelphia 368, both being flag-ships. The men are distributed as follows:

WATCH PETTY OFFICERS.

	Chi.	Phil.
Chief boatswain's mates	1	1
Chief quartermasters	1	1
Boatswain's mates	3	2
Gunner's mates	2	2
Quartermasters	3	4
Quarter gunners	6	6
Ship's corporals	2	1
	18	17

PETTY OFFICERS AND IDLERS.

Masters-at-arms	1	1
Equipment yeomen	1	1
Engineer's yeomen	2	1
Paymaster's yeomen	2	1
Apothecaries	1	1
Captains of hold	2	1
Ship's cooks	1	1
Baymen	2	2
Ship's writers	1	1
Barbers	1	1
Jack-of-dust	1	1
Tailors	1	0
Buglers	2	1
Steward to com.-in-chief	1	1
Cook to " "	1	1
Servant to " "	1	1
Cabin steward	1	1
" cook	1	1
" boy	1	1
Ward-room steward	1	1
Ward-room cook	1	1
" " boys	10	7
Junior officers' steward	1	1
" " cook	1	1
" " boys	3	2
Warrant officers' steward	1	1
" " cook	1	1
" " boy	1	0
	44	35

ENGINEER'S FORCE.

Machinists	8	8
Water-tenders	5	3
Oilers	12	12
Boilermakers	0	1
Blacksmiths	2	2
First-class firemen	12	14
Second-class firemen	15	14
Coal-heavers	36	36
	90	90

DECK FORCE.

Captains of forecastle	2	2
" " tops	4	2
Coxswains	11	9
Seamen	57	36
Ordinary seamen	54	36
Landsmen	26	36
Apprentices	43	40
	197	161

MECHANICS AND DYNAMO TENDERS.

	Chi.	Phil.
Armorers	2	1
Blacksmiths	1	1
Carpenter's mates	1	1
Sailmaker's mates	1	1
Painters	2	1
Carpenters and caulkers	4	3
Dynamo machinists	1	1
Oilers for dynamo	3	3
Printers	1	1
	16	13

MARINES.

	Chi.	Phil.
Orderly sergeant	1	1
Sergeants	3	2
Corporals	4	3
Bugler	1	1
Drummer	1	1
Privates	46	28
	56	36
Band	21	16
Total	442	368

This comparison needs some explanation. In the first place, the regular additional allowance for commander-in-chief is 34, distributed as follows:

Seamen	6	Cook	1
Ordinary seamen	6	Steward	1
Landsmen	2	Printer	1
Band	16		
Coxswain	1	Total	34

On the Chicago there are 21 in the band, and an engineer's yeoman is allowed for admiral's writer, making the total allowance 40. On the Philadelphia, on the other hand, the allowance of six seamen and six ordinary seamen is disallowed, and the total is only 22. On the latter, therefore, the barge's crew comes out of the ship's complement. The Chicago being a gun-deck ship has an extra boatswain's mate and ship's corporal.

In the revised organization here proposed for our new ships of from 1200 to 10,000 tons displacement, the principal change is in basing the organization on the gun instead of on the sail power. The parts of ship are abolished and gun divisions substituted. The gun's crew is preserved intact in the entire watch, quarter and station bill, and constitutes, with the machine-guns' crews of the division, a section at artillery, a platoon at infantry, a running boat's crew, and going in the same boat at "arm and away" and "abandon ship." No special-duty men or excused men should come out of the gun divisions, which last comprise the entire deck force. All special-duty men are in the powder or navigator's division, and there are as few such men allowed as possible, every effort being made to have a

large working deck force. In case the marines are not withdrawn from service afloat, they should be reduced in numbers and regarded as special-duty men, which means that they would constitute a division of the powder division in the quarter bill, but otherwise be under the command of their own officer. However, it is assumed that the marines are to be withdrawn. The important factor to be first dealt with in adapting our organization to modern conditions is the powder division. The character and distribution of the chains of ammunition supply make it obvious that a large number of men are required to deliver the same to the numerous guns now constituting a modern ship's battery. Men at the guns are more or less protected by shields; men in the ammunition supply are mostly on or above the protective deck and entirely exposed, as the coal protection is only furnished the boilers and engines, hence the principal casualties will be in the powder division. On them will devolve also largely the care of the wounded passed below in action, yet at all times the rapid supply of ammunition is of vital importance. This fact, coupled with the necessity for closing water-tight doors when about to ram or in any danger of being rammed, just when ammunition is also most needed with rapidity, leads to the necessity for drawing on the engineer's force for the reserve for the powder division in action. Under ordinary circumstances the powder division must be organized without counting in any of the engineer's force, which should constitute the reserve, but of all things this division must not be short-handed. The automobile torpedoes are mostly handled in the region of the ammunition supply, and the torpedo division is here included as a division in the powder division. This brings us to a very important and very necessary change in the assignment of commissioned officers to divisions.

A consideration of the burden imposed upon an executive officer of a modern cruiser of large displacement, by the care of the hull and below decks, and the ever-increasing duties of looking out for the complicated needs of such a ship, leads inevitably to the conclusion that he should in a measure be indirectly relieved by a competent assistant from some of the duties which now bear so hard upon him. The senior watch officers, from their age and experience in the service, are entitled to share in these duties, and it is here proposed that, on first and second rates, the officer now corresponding to senior watch officer hereafter be designated as first lieutenant, and the executive officer as executive officer only. The first lieutenant

shall have charge of the powder division, but shall not keep a watch. He shall, under the executive officer, be charged with the discipline of the lower decks, and of the special-duty and other men who clean, paint, and police the compartments and inside hull of the ship. He shall have charge of the general messing system and its inspection; shall regulate the ventilation of the ship below decks; shall have charge of the water-tight doors, traps, valves, pumps, and drainage system of the ship; and shall have charge of the police and sentries of the ship in the preservation of discipline and in the faithful and efficient discharge of their duties. He shall serve as senior member of boards of survey and inspection, summary courts-martial, board for the examination of seamen and petty officers for ratings to higher ratings than those held by them; and shall have personal and direct supervision of the instruction of landsmen, ordinary seamen, and apprentices to fit them for higher ratings. The executive officer shall continue to discharge the same duties as at present. The first lieutenant is simply to be a well-qualified assistant on whose knowledge and judgment, founded on experience in the service, the executive officer can rely. The work put on a modern executive officer simply means that he does as much as flesh and blood can accomplish and the rest must be more or less neglected. In most cases nothing is neglected, but the physical strain is too great and should be shared by a competent assistant. This is the custom in other services that might be named, and it is founded on reason and common sense.

With a modern powder division twice the size of a gun division, with the care and manipulation of automobile torpedoes added, and with the various chains of ammunition supply cut off from one another by the water-tight subdivisions, not to mention the exposed position of most of the powder division in even armored ships, it is not too much to say that the first lieutenant should have the assistance of one or more of the junior watch officers, or ensigns not standing watch, to properly carry out the complicated duties of the officer in charge. There being no marine officer in the ship, the duties of such could be incidentally performed by the first lieutenant as far as supervision and inspection of sentries, etc., is concerned. Any officer specially qualified in torpedoes should be assigned to the powder division as assistant in charge of the torpedo division. The more this scheme of having an officer of rank in charge below decks is considered, the more it will commend itself to the service at large.

It is not a new idea in any sense, but we need to adopt it. In view of the enormous amount of clerical work required at present in the executive and navigation departments of a ship, two writers should be allowed, one for the executive officer as now, and the other for the navigator and first lieutenant, between them.

With regard to the allowed complement of ships there are certain ratings which should be increased in number. A chief gunner's mate should be allowed each ship carrying automobile torpedoes, whether there is a gunner aboard or not. The allowance of quarter gunners should be one for each large gun of eight inches or over, one for each pair of five or six inch guns, and one for the secondary battery. The armorer should also serve with the secondary battery. Two painters should be allowed to large ships, and the carpenter's gang increased to six carpenters and caulkers, in addition to the carpenter's mate, as the duties now required in the iron work and valves, pumps, etc., are quite additional to the former work of the gang. The commander-in-chief's additional allowance for new ships should be as follows:

Coxswains	1	Cooks	1
Seamen, for orderlies	4	Band	16
Landsmen	2		—
Printers	1		26
Stewards	1		

As to the new watch, quarter, and station bill adapted to modern cruisers and battle-ships of from 1200 to 10,000 tons displacement, a consideration of the present allowed complements of vessels shows that the crews are distributed about as follows:

	550 to 400 men.	400 to 300 men.	300 to 200 men.	200 to 100 men.
Petty officers, mechanics and idlers	16 per ct.	18 per ct.	22 per ct.	28 per ct.
Engineer's force	20 "	24 "	26 "	28 "
Marines	10 "	10 "	10 "	10 "
Deck force	54 "	48 "	42 "	34 "

Transferring the marines to service on shore and doing away with as many special-duty men as possible, the new percentages should be as follows:

	550 to 400 men.	400 to 300 men.	300 to 200 men.	200 to 100 men.
Petty officers, mechanics and idlers	22 per ct.	24 per ct.	28 per ct.	34 per ct.
Engineer's force	20 "	24 "	26 "	28 "
Deck force	58 "	52 "	46 "	38 "

These figures are of course approximate, but indicate at least the relative needs of large and small ships. Special conditions will of course call for a modification of these allowances to suit peculiar types of ships.

As the gun divisions take the place of parts of the ship, it may be well to first outline the changes needed in the present watch bill of our ships. In gun-deck ships, or in turret or barbette ships also carrying guns in an armored casemate, central citadel or superstructure, there should be four gun divisions. In all other ships there should be three. As these gun divisions are to constitute the parts of ship, the watch numbers of the first division should run from 101 to 200 inclusive, which would give for the fourth division 401 to 500 inclusive.

The numbers from 1 to 100 inclusive should be given to petty officers, mechanics and idlers. Those from 1 to 24 inclusive should be for petty officers, mechanics, and idlers who do not stand watch, and should run as follows:

1. Master-at-arms,
2. Ship's steward,
3. Electrician,
4. Apothecary,
5. Equipment yeoman,
6. Pay yeoman,
7. Chief gunner's mate,
8. Engineer's yeoman,
9. Ship's writer,
10. Ship's writer,
11. Chief quartermaster.
12. Printer,
13. Captain of hold,
14. Captain of hold,
15. Bugler,
16. Bugler,
17. Painter,
18. Painter,
19. Bayman,
20. Bayman,
21. Sailmaker's mate,
22. Tailor,
23. Jack-of-the-dust,
24. Barber.

The watch numbers from 25 to 80 inclusive should embrace the petty officers, mechanics, and idlers who stand watch at sea, or in port, or both, as follows:

25. Chief boatswain's mate,
26. Boatswain's mate,
27. Boatswain's mate,
28. " "

29. Gunner's mate,
30. Gunner's mate,
31. Armorer,
32. Armorer,
33. Quarter gunner,
34. Quarter gunner,
35. " "
36. " "
37. " "
38. " "
39. " "
40. " "
41. " "
42. " "
43. Quartermaster,
44. Quartermaster,
45. "
46. "
47. Signalman,
48. Signalman,
49. "
50. "
51. Ship's corporal,
52. Ship's corporal,
53. " "
54. " "
55. " "
56. " "
57. " "
58. " "
59. Dynamo tender,
60. Dynamo tender,
61. " "
62. " "
63. Carpenter's mate,
64. Carpenter and caulker,
65. Carpenter and caulker,
66. " " "
67. " " "
68. " " "
69. " " "
70. Coxswain of steam launch,
71. Seaman, steam launch,
72. Ordinary seaman, steam launch,
73. Side cleaner,
74. Side cleaner,
75. " "
76. " "
77. Messenger,
78. Messenger,
79. "
80. "

The numbers from 81 to 100 should include the ship's messmen, as follows:

81. Ship's cook,
82. Ship's cook's assistant,
83. Pantryman,
84. Baker,
85. Messmen,
86. Messmen,
87. "
88. "
89. "
90. "
91. "
92. "
93. "
94. "
95. "
96. "
97. ...
98. ...
99. ...
100. ...

The watch numbers from 501 to 600 inclusive should be distributed as follows:

From 501 to 550, the marine guard, or, in case the guard is withdrawn, those having corresponding duties should be here enrolled. In the latter case this group should contain numbers for four flag orderlies, four cabin orderlies, and one mail orderly. The other numbers should be reserved for the compartment men. From 551 to 570 inclusive should be the band numbers, and from 571 to 600 inclusive the cooks, stewards and servants, exactly as in the present watch bill.

The numbers from 600 upwards should be the engineer's force.

The quarter bill should be, in respect to names, a copy of the watch bill for the gun divisions, with one quarter gunner added for each division. The remainder of the crew, exclusive of the engineer's force, should be in the powder, navigator's, or torpedo division.

There it no necessity in a modern man-of-war for a large navigator's division. In action everything is now controlled from an armored fighting-tower, and the handling of the ship is confined to very few people. The custom now is to assign one or more machine guns to this division. It is here proposed that the following men compose the navigator's division: the chief boatswain's mate, chief quartermaster, carpenter's mate, and one carpenter and caulker, four quartermasters, four signalmen, four messengers, one ship's writer, two buglers and an armorer, in all nineteen men as a maximum. It will be found that these are the men most needed on the spar-deck in emergencies likely to arise in action. The allowance of four messengers is meant to cover the necessity in large ships for two for the officer-of-the-deck and two for the executive officer. An armorer should be handy in case of accident to the mechanism of guns or gun-carriages. The carpenter's mate and assistant should be on the spar-deck under the control of the commanding, executive, or navigating officer, to receive directions as to trimming the ship, in case of accident, by pumping out or letting water into certain compartments, under the supervision of the carpenter, who should also be attached to the navigator's division as an aid.

The torpedo division should be incorporated in the powder division, under the immediate control of the torpedo officer, but under the command of the first lieutenant, as being on the protective deck. It should consist of the following men: chief gunner's mate, one ship's writer, two dynamo tenders, two ship's corporals, and all the

special compartment men, including also the mail orderly and four side-cleaners, in all about eighteen men. While in a special way this division will be called upon in action, at more or less close quarters, to manipulate torpedoes, yet their general duties at all other times should also be to close water-tight doors, rig pumps, close air-duct valves, etc., on signal from deck, or by order of the first lieutenant, where necessary in cases of emergency, as best determined by those below. This division will also act as aids to the wounded sent below or belonging to the powder division. This implies that the torpedo division will be scattered throughout the length of the ship on the protective deck. That is as it should be, as by special signal the men can be called together when about to discharge one or more torpedoes. Men in the powder division whose stations in action are on the protective deck should also be detailed to close water-tight doors, etc., on special signal, as it is important that two men be assigned to perform one duty of this kind, to decrease the chances of failure through the absence of one or the other. In case there are no torpedoes furnished the ship, the men here named as constituting the torpedo division would, of course, be assigned directly to the powder division.

The powder division should be composed of those men whose watch numbers range from 1 to 100 and 500 to 600 not otherwise assigned to the navigator's or torpedo division. The coal-heavers and first and second-class firemen of one division of the engineer's force should constitute the reserve of the powder division, to be drawn on in case of necessity. The steam launch's crew, though assigned to the powder division, are only nominally in it. In port the steam launch is generally busy, and at sea and in action this crew should be stationed in the steering-engine compartment. At sea they should stand in three watches, to oil and tend the steam-steering gear, and to stand by to shift from steam to hand gear in cases of emergency. In action all three should be there for the same purpose, with the additional duties of connecting up the preventer-tiller ropes or relieving tackles, or in assisting to ship the spare tiller in case of accident to both the ordinary hand and steam gear.

The engineer's division in the new watch and quarter bills should be assigned more space than is now given in the present bills.

In relation to the fire bill, only one remark seems called for in the arrangement and running of steam hose. The latter is kept in racks usually some little distance from the fire-plugs on the steam-main,

and in the course of numerous drills the threads are stripped in coupling up hastily. It is here suggested that the pipe leading from the fire-main to each fire-plug be branched, with a valve on each branch. To one fire-plug the fire-hose should always be kept coupled and neatly made up, but handy in case of fire, with nozzle attached ready for running. The other plug should be used for washing decks, etc.

One boat bill should answer for "Running boats," "Arm and away," and "Abandon ship." The same crew should go in each boat under all three circumstances, but in other than running boats the additional men should be indicated by watch numbers under the sub-headings "Arm and away" and "Abandon ship." A boat's crew should be picked from each watch of a gun division, which is practically the same thing as assigning a gun's crew to a boat. The steam launch and sailing launch should be manned from the powder division. The gig's, barge's and dinghy's crews should come from the gun divisions equally, preferably from the machine-guns' crews. Ships should be furnished with small boats pulling double sculls for purposes where they readily take the place of larger boats during drill hours and after dark. The life-rafts, etc., for abandoning ship should belong to the navigator's, powder, and torpedo divisions.

In the organization of the battalion, the powder division should constitute the artillery and the ammunition supply; the navigator's, the color guard; and the pioneer's should be taken from the mechanics and engineer's force. Each gun division should constitute a company of infantry.

In the station bill such changes in the watch numbers should be made as to make it correspond with the new watch bill. To what are already given in the station bill as evolutions, should be added "Closing water-tight doors" and "Coaling ship." In coaling ship with the ship's company, as few should be excused from work as possible.

In summarizing what has been here proposed, it may be stated in a general way that the object sought is to secure for our ships (1) homogeneous crews composed of men who are Americans, or who have declared their intention of becoming citizens of the United States; (2) uniformity in the organization and drills of ships, in the training of men, and in the requirements for advancing men from one rate to another; (3) such improved comforts and consideration as will increase the real efficiency of the crews, and render the service more attractive than at present; (4) the retention of men in the service for life by making a career for them as men-of-wars-men.

Much remains to be done in raising the tone of first-class and other petty officers, by weeding out and getting rid of untrustworthy and dissolute men, and by granting to those deserving it, every privilege consistent with the maintenance of efficiency and discipline. In the case of second-class petty officers, their mustering uniform should be the same as for first-class petty officers, excepting, of course, the devices or rank marks. Men on sentry duty should wear a belt and cutlass. This applies equally to ship's corporals at all times, and to coxswains and quartermasters on watch. Men in the gun divisions should wear on the sleeve, corresponding to their watch, the figures 1, 2, 3, or 4, in white, according to the number of the division they are in, and this in place of the present white tape watch-mark. Men on the sick list should be required to wear the white band with red cross as prescribed.

In any discussion of the needs of the service, due regard must be had to the quiet revolution that is going on in our profession. Whether we close our eyes or not to the inevitable, we will never have an efficient navy until we infuse more of a military spirit into it, and until we recognize that we must provide a career for the men, with rewards and pensions for service as substantial relatively as those provided for officers.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON AN EXPERIMENTAL AMMUNITION CART, CONSTRUCTED FOR THE ORDNANCE DEPARTMENT.

By Lieutenant W. W. Kimball, U. S. Navy.

The cart was designed to illustrate an attempted solution of the problem of "How, in these times of rapid-firing arms of precision, shall the infantry fighting line be supplied with ammunition?" Before discussing the device, it will be well to briefly glance at the main limiting conditions of the problem, and incidentally at the way they are generally met.

On the march there is, of course, no more difficulty about transporting ammunition by animal draft than about moving any other weights; but after the fight begins, animals cannot be depended upon to get nearer than 2000 yards to the enemy's position, while the ammunition will be wanted well up to the front—wherever the line may be when the regular person-borne supply begins to run out —anywhere from 600 to 1200 yards from the hostile lines.

The systems of the French and German armies may be quoted as examples of the generally approved methods for supplying the fighting lines. In these armies, apart from the ammunition regularly issued to the troops, the entire field supply transported in the battalion ammunition wagons, company baggage wagons, ammunition columns, and park reserves, amounts to 99 and 97 rounds per man, of which 18 rounds for the French and 20 rounds for the Germans are carried in the battalion ammunition wagons.

The German regulations provide that, "Before action is commenced, the ammunition wagons of a regiment are united under a mounted officer, in a secure position about 900 yards in rear of the fighting troops. In case of need they must be taken to the fighting

line regardless of loss. The cartridges are taken to the front by men from each company; and supports sent on to the fighting line should take with them cartridges for those already engaged."

In the French army the rule is, "In action the battalion ammunition wagons are grouped together not more than 1100 yards to the rear. In case of necessity they may be ordered right up to the fighting line. Cartridge-bearers must be furnished by the companies in reserve, and are provided with double haversacks, kept in the wagons, and capable of containing 360 rounds. After carrying the ammunition to the fighting line and distributing it, the bearers must return for more."

Of these two typical systems it may be remarked that, if the line to be supplied was up within 800 yards of the enemy, the attempt to take animal-drawn wagons up to it in the face of the fire of fairly good modern-armed infantry—no matter how great the need might be that "they must be taken to the fighting line regardless of loss'—would prove very expensive in men, animals and material, and would result in little, if any, ammunition supply to the line.

In regard to the ammunition-bearers, it is to be noted that their chance of arrival is better than that of the wagons, in the proportion that the target exposed by a man is harder to strike than the one presented by a team; and that it requires a bearer for each 360 or 400 rounds carried from the wagons to the line.

Assuming, then, that men, not animals, must be employed within effective ranges, the question for consideration becomes one of advancing a given amount of ammunition from 800 to 1400 yards across a fire-swept zone and distributing it to the line in the shortest practicable time and with the greatest economy in the use of the ammunition detail.

The accompanying illustrations show that the device employed in the experimental vehicle is the using of specially constructed wheelbarrows, capable of being coupled together to form a cart for animal-draft on the march, and readily uncoupled for man-propulsion across the fire-swept zone. As the barrow has but one point of contact with the ground, it is readily passed around and between obstructions, and can be taken nearly anywhere that a loaded ammunition-bearer can go, while it is to be borne in mind that if the barrow be stopped by an obstacle impassable for it, but practicable for bearers, the bearers may be used from the obstacle to the front, instead of all the way from the train to the fighting line.

In regard to economy of time and ammunition detail, it has been found by experiment that, under ordinary service conditions of ground, two men with a barrow can move 4000 rounds a half mile in less time than they can carry 800 rounds the same distance.

When deep mud or very steep up-grades are encountered, the advantage of the barrow is decreased; on fairly firm turf, on hard ground, and on easy down-grades, it is increased. Averaging conditions of ground, the barrow has, in economy of time and men, about 5 to 1 in its favor over the borne-ammunition method.

These barrows are provided with a mechanical distributing device, by which the ammunition can be dropped at will in lots of two hundred rounds for each pull on the handles, and an automatic attachment by which the same distribution unit is dropped at each revolution of the wheel, so that the distribution can be made with the barrow-men on a dead run, and their time of entire exposure to fire decreased to a minimum.

The distributing device is a simple ratchet lever and draw-bar arrangement which releases in succession the traps which form the bottoms of the cells, each of which contains a unit of distribution of 200 rounds. The succession of the several releases is such that the center of gravity of the whole barrow-load is never altered, except by an amount due to the dropping of one unit of distribution, an amount which is entirely corrected as the next unit falls.

The device is simple and not liable to get out of order by exposure to weather, dust and mud; still it is not wholly positive in its action, since a return-spring is used to save the man from having to think of a necessary movement. On the whole, the mechanical distribution, although it does save time under fire, is of doubtful utility, because it might unexpectedly fail in its functions, and because the use of it, no matter what may be the distribution unit employed, demands the cellular arrangement of the barrow-caissons.

It would seem preferable to employ a light angle-steel frame instead of the caissons, the frames arranged to receive 500 round wooden factory boxes of the proper dimensions for use on the barrow. In such boxes the cartridges would be collected in good packing units for factory and depot accounting and stowage purposes, in packages not too heavy for a man to pick up and carry some distance, in convenient bulks for rail or other transport; and they would be always ready for quick transfer to the carts, formed of barrows, would keep dry when so transferred for any length of

time in any weather, and would never leave their factory packing until they were delivered to the troops on the fighting line or anywhere else.

When the boxes were placed on the carts the cover-screws would be removed and the covers held in place by the angle-steels and retaining bolts only; so that, when a box was thrown off on the line, the men could get at the cartridges without having recourse to the always lost and much inquired-for screw-driver.

It is doubtful whether the fore-and-aft barrow-shafts are preferable to the cross-bar arrangement shown in Plate V. The shafts allow the barrow to pass through long, narrow spaces and separate the barrow-men more while distributing along the line, although they place one man directly in rear of the other in the advance to the line; the cross-bar is simpler of construction, gives better side support, and allows shorter turns to be made. On trial through ordinary New England woodland there was no very noticeable difference in the ease with which the way among the trunks and stumps could be threaded, whether using the shafts or the bar.

As the barrows are emptied of ammunition they may be thrown down upon the field as the detail joins the fighting line, and collected to couple up into carts after the action. The use of the empty barrows in clearing up the field reduces the stretcher detail one-half, since with a barrow with stretchers rigged (Plate VI) a detail of two can take two wounded to the hospital, or two dead to the trench, in less time than it can take one on a borne stretcher. As was satisfactorily shown on trial at Governor's Island, there is no difficulty whatever in using the barrow with only one stretcher loaded when collecting the wounded or dead.

The empty barrows with stretchers in place could upon occasion be used for moving sand-bags, or fire-wood, or for any small transport work about the field.

The shaft frame for animal-draft of this cart was made to take two barrows with the folding shafts shown in the illustrations, and for such barrows the travois-like arrangement answers the purpose fairly well.

In a design for a trial of the barrow device abroad, a pole replaces the shafts, the travois extension from the cross-piece is not used, and four barrows, the two outer ones tracking with the field artillery, are coupled to the cross-piece by eyes and bolts, and held normally at right angles to the pole in the vertical plane by spring struts,

which allow a certain amount of independent vertical motion to the barrows, for the purpose of decreasing lateral strains when any one of them passes over an obstruction such as a stone or a stump.

With such a battalion cart, two good horses, with the driver mounted on the near one, can take 16,000 rounds—a 20-round supply for a battalion 800 strong—over country impassable for a wagon, and have the ammunition always ready for rapid distribution by an eight-men detail.

The general design of the barrow with the large wheel, centrally borne load and consequently small axle, was originally worked out to provide a means for allowing a reduction in the large draft-crews now necessary for the machine guns and one-pounders in our naval landing parties, and for decreasing the targets presented by the pieces in action.

Take the service one-pounder as an example. The piece, the trail mount consisting of low support socket, pivot and recoil brace, and 100 rounds of ammunition, loaded upon a barrow, could be taken over rougher country than is practicable for the present field carriage, and on the march the crew of six men would be obliged to exert less effort per man than does the present crew of double the number.

In going into action, the barrow could be rushed forward to an ordinary shelter trench made by the advanced infantry, the piece tripod and ammunition boxes thrown off, the barrow thrown down on its side, the piece mounted on its low mount and served by its crew lying down, and thus as much invisibility and cover secured from a 22-inch shelter trench parapet as it gives to infantry.

Or the piece and mount could be placed on one very light barrow, and the ammunition—150 rounds—on another. On the march the two could be coupled together, or handled separately, according to conditions of route. In the rush forward into action, the barrows would be manned separately with a crew of three men each, which would allow them to arrive if each crew lost a man in the advance.

Of course, the use of barrows is applicable to any pieces which must be gotten well forward to have them effective, and which must expose as little target as possible in order to be able to remain well forward. Such rifle caliber machine guns as the Maxim, the Pratt Whitney, the Gardner, and the Nordenfelt can be handled in like manner to that above described for the one-pounder. The Gatling and its ammunition can well be transported on the barrows, but that gun cannot be served by a prone crew, because the mount must be

waist high, and the crank-man must stand in order to be able to put his full effort on the crank and so bring out the full power of the piece. Although the barrow-wheel has a large diameter, the barrow frame is so narrow that the whole device would stow better and occupy much less available space aboard ship than does the trail-carriage; and the arrangement of the load is such as to allow its separation into convenient weights for stowing in boats, or for passing across or over streams, marshes, ditches and walls.

The system will be tried abroad, and if approved by foreign navies, may then, possibly, be domesticated in our own service.

TITLES OF PLATES—KIMBALL AMMUNITION VEHICLE.

No. 1.—"Ammunition detail to the train!" Men at the cart.

No. 2.—"Unlimber and advance to the line!" *a.* Unlimbering; *b.* Advancing.

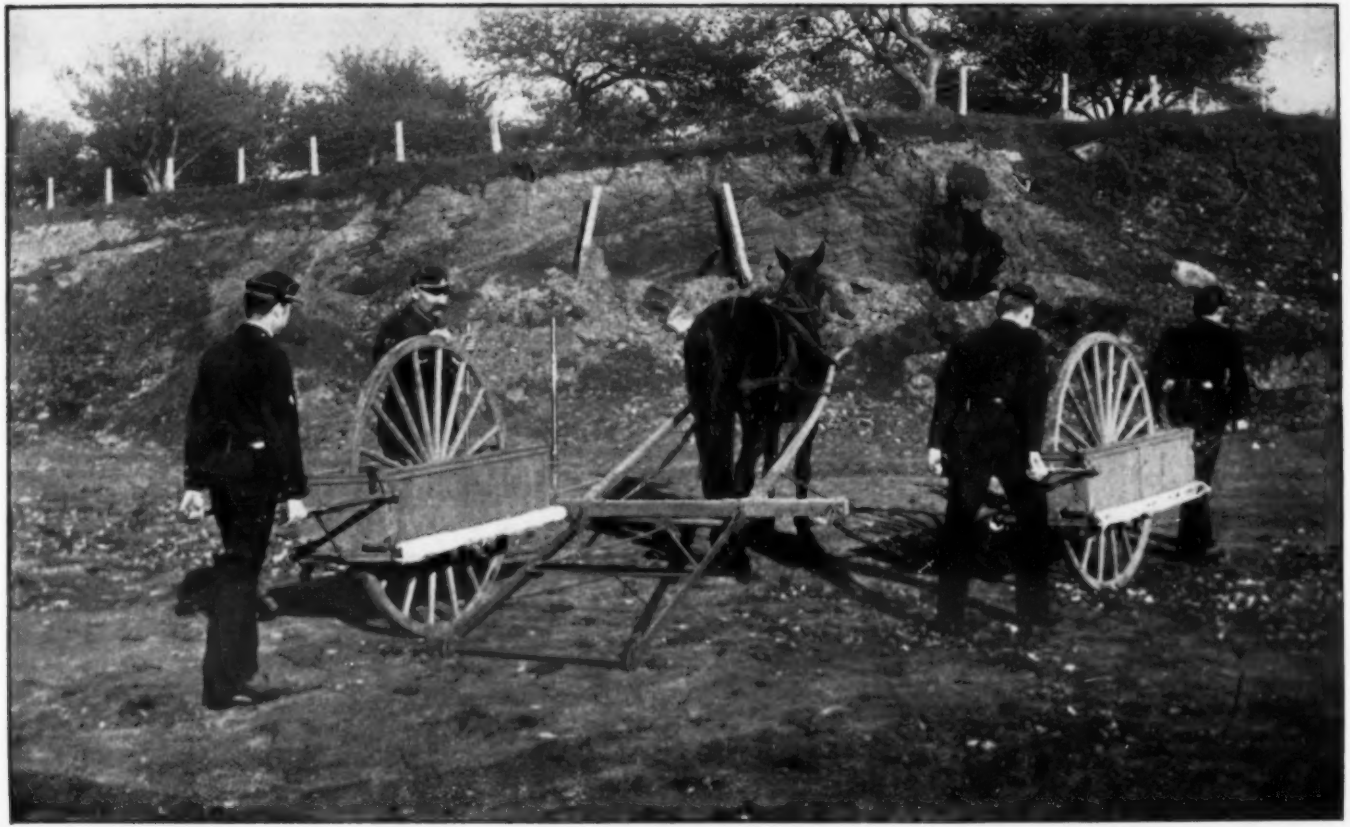
No. 3.—"Obstacle! Double the detail to pass!" *a.* Passing obstacle; *b.* Barrow awaiting return of double detail after *a* has passed obstacle.

No. 4.—"On the line and distribute!" *a.* Automatic distribution, dropping 200 rounds at each revolution of the wheel; *b.* Distribution at will.

No. 5.—Shafts and distributing gear carried away. "Distribute by hand! Forward!" *a.* Distributing by hand; *b.* Forward.

No. 6.—After the action. "Clear up the field!" *a.* Barrow as thrown down after being emptied when the detail joined the fighting line; *b.* Wounded to hospital, or dead to the trench.

PLATE I.—AMMUNITION DETAIL AT THE TRAIN.



a. Unlimbering. b. Ready to advance.

PLATE II.—"UNLIMBER!"

PLATE III.—OBSTACLE. DOUBLE DETAIL TO PASS.

a, Stretcher bar shipped to give four men place.

b, Shafts turned down to form legs for barrow.

PLATE III.—OBSTACLE. DOUBLE DETAIL TO PASS.

PLATE IV.—ON THE LINE. DISTRIBUTE.

a, Automatically. b, At will.

PLATE IV.—ON THE LINE. DISTRIBUTE.

PLATE V.—SHAFT AND DISTRIBUTING GEAR WOUNDED.

a, "Halt! Distribute by hand."

b, "Forward!"

PLATE V.—SHAFT AND DISTRIBUTING GEAR WOUNDED.

a. Barrow thrown down after being emptied.

b, Wounded to hospital or dead to the trench.

PLATE VI.—AFTER THE ACTION.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SIACCI'S BALLISTIC EQUATIONS.

By Prof. Wm. Woolsey Johnson, U. S. Naval Academy.

The following is an account of the mode in which Major Siacci derives his ballistic formulae in the second edition of "Balistica," published at Turin in 1888. A few changes have been made in the notation.

It is assumed as usual that, δ denoting the density of the air and d the diameter of the projectile, the resistance of the air for similar projectiles is proportional to δd^2. The retardation, found by dividing the resistance by the mass, is therefore proportional to $\frac{\delta d^2}{w}$ or $\frac{\delta}{C}$, where C is the ballistic coefficient. Again, for projectiles having the same velocity, the same diameter and weight, but different forms, the retardations are proportional to the values of a coefficient i depending upon the form of the projectile. Representing, then, the retardation by $f(v)$, a function of the velocity, we may write

$$f(v) = \frac{\delta i}{C} F(v),$$

so that $F(v)$ is a function of v, independent of the form, weight and dimensions of the projectile, and of the density of the air.

Now, φ denoting the inclination to the axis of x of the trajectory at the point (x, y), the equations of motion are

$$\frac{d\,(v \cos \varphi)}{dt} = -f(v) \cos \varphi, \tag{1}$$

$$\frac{d\,(v \sin \varphi)}{dt} = -f(v) \sin \varphi - g. \tag{2}$$

Eliminating $f(v)$,

$$v \cos \varphi\ d(v \sin \varphi) - v \sin \varphi\ d\,(v \cos \varphi) = -gv \cos \varphi\ dt,$$

and, dividing by $v^2 \cos^2 \varphi$,

$$d \frac{v \sin \varphi}{v \cos \varphi} = - \frac{g dt}{v \cos \varphi},$$

or

$$\sec^2 \varphi \, d\varphi = - \frac{g}{v} \sec \varphi \, dt,$$

whence

$$g dt = - v \sec \varphi \, d\varphi. \tag{3}$$

Substituting in (1), we have

$$g d(v \cos \varphi) = f(v) v d\varphi, \tag{4}$$

the differential equation connecting v and φ.

If this equation could be integrated, v would become a known function of φ, and then t could be found from (3) by quadrature, and in like manner x could be found from the equation

$$g dx = gv \cos \varphi \, dt = - v^2 d\varphi, \tag{5}$$

and y from

$$dy = \tan \varphi \, dx. \tag{6}$$

But, since (4) cannot be integrated, it is necessary to have recourse to approximate integration.

First substituting in (4) the value of $f(v)$, and introducing a new variable z, such that

$$v \cos \varphi = z \cos \theta, \tag{7}$$

where θ is the initial value of φ, or "angle of projection," we have

$$g dz = \frac{\delta i}{C} F(v) z \frac{d\varphi}{\cos \varphi}, \tag{8}$$

and, by the change of variable from v to z, (3) and (5) become

$$g dt = - z \cos \theta \frac{d\varphi}{\cos^2 \varphi}, \tag{9}$$

$$g dx = - z^2 \cos^2 \theta \frac{d\varphi}{\cos^2 \varphi}. \tag{10}$$

The new variable z is a fixed multiple of the horizontal velocity, and may be described as the component of the velocity in the direction of the initial tangent or line of projection *when the other component is vertical.* It is known as the pseudo-velocity: its value coincides with that of the velocity at the origin and at the point in the descending branch where $\varphi = - \theta$; between these points its value exceeds that of the velocity.

In order to reduce (8) to an integrable relation between the two variables z and φ, Siacci puts

$$F(v) = \beta F(z) \frac{\cos^2 \theta}{\cos \varphi}, \tag{11}$$

in which β, which in general has a very restricted range of variation, is assumed to be constant. The equation thus becomes

$$g dz = \frac{\delta i \beta \cos^2 \theta}{C} z F(z) \frac{d\varphi}{\cos^2 \varphi},$$

or

$$\frac{d\varphi}{\cos^2 \varphi} = \frac{C}{\delta i \beta \cos^2 \theta} \frac{g dz}{z F(z)}; \tag{12}$$

and, substituting in (9) and (10), we have

$$dt = -\frac{C}{\delta i \beta \cos \theta} \frac{dz}{F(z)}, \tag{13}$$

and

$$dx = -\frac{C}{\delta i \beta} \frac{z dz}{F(z)}. \tag{14}$$

Now putting

$$\frac{C}{\delta i \beta} = C',$$

in which C' is assumed constant and is called the reduced ballistic coefficient, and denoting the integrals

$$-\int \frac{z dz}{F(z)}, \quad -\int \frac{2g dz}{z F(z)}, \quad -\frac{dz}{F(z)},$$

by

$$S_z, \qquad I_z, \qquad T_z,$$

respectively, the integrals (reckoned from the origin where $z = V$) of equations (12), (13) and (14) are

$$\tan \varphi - \tan \theta = -\frac{C'}{2 \cos^2 \theta} [I_z - I_v], \tag{15}$$

$$t = \frac{C'}{\cos \theta} [T_z - T_v], \tag{16}$$

$$x = C' [S_z - S_v]. \tag{17}$$

Moreover, multiplying (15) by the differential of (17), equation (6) gives

$$dy - dx \tan \theta = -\frac{C'^2}{2 \cos^2 \theta} [I_z - I_v] dS_z;$$

and writing A_z for

$$\int I_z dS_z, \quad \text{or} \quad -\int I_z \frac{z dz}{F(z)},$$

the integral of this is

$$y - x \tan \theta = - \frac{C'^2}{2 \cos^2 \theta} [A_z - A_r - I_r (S_z - S_r)],$$

or, dividing by (17),

$$\frac{y}{x} - \tan \theta = - \frac{C'}{2 \cos^2 \theta} \left[\frac{A_z - A_r}{S_z - S_r} - I_r \right]. \qquad (18)$$

Equations (15), (16), (17) and (18), together with (7), or

$$v = z \frac{\cos \theta}{\cos \varphi}, \qquad (19)$$

are the ballistic formulae expressing x, y, φ, t and v in terms of the auxiliary variable z. They are to be used in connection with Ballistic Tables containing the numerical values of S, A, I and T for all values of z.

Of these equations, which were first published in 1880 (Giornale d'Artiglieria e Genio, P. II), the author says: "The arithmetical operations which they require are of the most simple kind; they are besides independent of the expressions for the resistance of the air, and therefore will not change, however much, with the progress of studies upon the resistance of the air, it may be necessary to change these expressions, which in fact will influence only the numerical values in the ballistic table. This table, indeed, may be constructed whatever be the resistance adopted, be it expressed by a single formula of any kind for all velocities, or by several formulae according to the limits of the velocity itself, or even be it not expressed by any formula, but only given *numerically* in correspondence with the numerical value of the velocity."

Supposing the ballistic tables to be correct, the approximative character of the method is due entirely to the quantity β, whose value, defined by equation (11), is

$$\beta = \frac{F(v)}{F(z)} \frac{\cos \varphi}{\cos^2 \theta}.$$

It is known that the retardation varies with a power of the velocity higher than the second, except for very high and very low velocities, in which cases it varies simply as the square of the velocity. Hence, putting

$$F(v) = v^2 K(v),$$

$K(v)$ is generally an increasing function of v. Substituting, we have since $v \cos \varphi = z \cos \theta$,

$$\beta = \frac{v^2 K(v)}{z^2 K(z)} \frac{\cos \varphi}{\cos^2 \theta} = \frac{K(v)}{K(z)} \sec \varphi.$$

At the origin $\varphi = \theta$ and $z = v$; whence $\beta = \sec\theta$, which exceeds unity. At the vertex $\varphi = 0$ and $z > v$; whence $\beta = \frac{K(v)}{K(z)}$ and is less than unity. To obtain exact results we ought in each formula to employ some mean value of β between the greatest and least value which occur within the limits of the arc of the trajectory under consideration. This mean value, which depends also upon the formula used, can of course in no case be exactly obtained. Confining his attention, however, to that which should be employed when, of the three quantities, the range, the initial velocity and the angle of projection, two are given and one is sought, the author shows that we may take $\beta = 1$ for angles of projection less than 20° in connection with usual initial velocities.

ON THE ANGLE OF ELEVATION IN ORDER THAT THE TRAJECTORY IN AIR SHALL PASS THROUGH A GIVEN POINT.

By Professor Wm. Woolsey Johnson.

1. Siacci's formulae for x and y, equations (17) and (18) of the preceding resumé, are

$$x = C'[S_s - S_v],$$

$$\frac{y}{x} - \tan\theta = -\frac{C'}{2\cos^2\theta}\left[\frac{A_s - A_v}{S_s - S_v} - I_v\right].$$

Suppose the values of x and y for a point of the trajectory, that is, the coordinates of a point to be hit (as well as the initial velocity, V, and the reduced ballistic coefficient, C'), to be known, and let it be required to find the value of θ. Putting s for the inclination to the horizon of the "line of sight," or line joining (x, y) to the origin, we have

$$\tan s = \frac{y}{x};$$

and the equations may be written

$$S_s = S_v + \frac{x}{C'}, \tag{1}$$

$$\tan\theta - \tan s = \frac{C'\sec^3\theta}{2}\left[\frac{A_s - A_v}{S_s - S_v} - I_v\right]. \tag{2}$$

Denoting by α "the angle of elevation," or angle between the line of sight and the axis of the bore at the moment the projectile leaves the muzzle, we have

$$\theta = s + \alpha; \tag{3}$$

whence

$$\tan \alpha = \frac{\tan \theta - \tan s}{1 + \tan \theta \tan s}.$$

Therefore, dividing by $1 + \tan \theta \tan s$, equation (2) may be written

$$\tan \alpha = \frac{1 + \tan^2 \theta}{1 + \tan \theta \tan s} \frac{C'}{2} \left[\frac{A_s - A_v}{S_s - S_v} - I_v \right]. \tag{4}$$

Put

$$\frac{1 + \tan^2 \theta}{1 + \tan \theta \tan \alpha} = 1 + \varepsilon.$$

Subtracting unity from each member,

$$\varepsilon = \frac{\tan \theta (\tan \theta - \tan s)}{1 + \tan \theta \tan s} = \tan \theta \tan \alpha.$$

If then we put

$$\tan \alpha_1 = \frac{C'}{2} \left[\frac{A_s - A_v}{S_s - S_v} - I_v \right], \tag{5}$$

equation (4) may be written

$$\tan \alpha = (1 + \varepsilon) \tan \alpha_1, \tag{6}$$

where

$$\varepsilon = \tan \alpha \tan (\alpha + s). \tag{7}$$

These formulae give the following method of computing α: By means of the ballistic tables we find z from equation (1), and then $\tan \alpha_1$ from equation (5). Now beginning with an approximate value of α (say α_1, since ε is small), we compute ε by (7) and then α by (6). If the value of α so found differs considerably from the approximate value used in computing ε, this quantity may be recomputed and so on until the value of $\log (1 + \varepsilon)$ is no longer changed, and (6) then gives the true value of α. [If a table of "addition logarithms" is at hand, the value of $\log (1 + \varepsilon)$ is found directly corresponding to the argument colog ε, and will be seen to vary very slowly.]

2. The angle α is always positive, hence ε in (7) is positive when s is positive, and also when s is negative and numerically less than α; in these cases therefore α is greater than α_1. When $s = -\alpha$, ε vanishes and $\alpha = \alpha_1$; this occurs when $\theta = 0$, the origin then being the vertex of the trajectory. For greater negative values of s, ε is negative and α less than α_1.

When $s = 0$, equation (2) gives the usual formula for a given horizontal range: namely, denoting the corresponding value of θ by γ, this is

$$\sin 2\gamma = C' \left[\frac{A_x - A_y}{S_x - S_y} - I_y \right]. \tag{8}$$

3. It has been usual to employ in the general case when s is not zero, the hypothesis of the "rigidity of the trajectory." This hypothesis consists in the assumption that if we find α for any horizontal range, that is, when $s = 0$, and then keeping α constant let s increase from 0, the trajectory will be rotated about the origin without change of form, so that the range upon the line inclined at the angle s will remain unchanged. The value of α upon this hypothesis is therefore the same as that of γ above, except that for x we should put the actual distance

$$X = \sqrt{(x^2 + y^2)} = x \sec s.$$

Denoting by Z the corresponding value of z as given by equation (1), this angle, which we shall denote by α', is determined by

$$\sin 2\alpha' = C' \left[\frac{A_z - A_y}{S_z - S_y} - I_y \right]. \tag{9}$$

This is a convenient approximation to α when a Range Table, computed for the given values of C' and V, is at hand. But it is to be noticed that such a table may be used instead of the ballistic table in connection with the exact method given above; for, comparing equations (5) and (8), we see that

$$\tan \alpha_1 = \tfrac{1}{2} \sin 2\gamma; \tag{10}$$

hence, taking from the range table γ instead of α' (that is, using the horizontal instead of the actual distance), we readily obtain $\tan \alpha_1$, and we can then proceed as before to find α from equations (6) and (7). When this is done, γ will be a better approximation than α_1, with which to commence the computation of ϵ, when s has a positive or a small negative value; for (10) shows that γ is always greater than α_1, and, as will be shown below, γ is less than α when s is positive, being equal to α when $s = 0$.

4. In order to discuss the degree of approximation of α' the result of the rigidity hypothesis, we shall first compare α with γ. Writing equation (10) in the form

$$\tan \gamma = \tan \alpha_1 \sec^3 \gamma,$$

and dividing (6) by this equation, we have

$$\frac{\tan \alpha}{\tan \gamma} = \frac{1 + \tan \alpha \tan (\alpha + s)}{1 + \tan^2 \gamma},$$

whence

$$\tan \alpha - \tan \gamma = \tan \alpha \tan \gamma [\tan (\alpha + s) - \tan \gamma]. \qquad (11)$$

Since α and γ are positive, $\tan(\alpha + s) - \tan\gamma$ and $\tan \alpha - \tan \gamma$ have the same sign, therefore γ is not intermediate in value to α and $\alpha + s$; and since in all practical cases $\tan \alpha \tan\gamma < 1$, γ is nearer to α than to $\alpha + s$; that is to say, *γ is less than α when s is positive, and greater than α when s is negative.*

Thus, if we put

$$\alpha = \gamma + \delta,$$

δ has the same sign as s. The value of δ when s is small is readily obtained from equation (11). The first member becomes

$$\tan \alpha - \tan \gamma = \frac{\tan \gamma + \tan \delta}{1 - \tan \gamma \tan \delta} - \tan \gamma = \frac{\tan \delta (1 + \tan^2 \gamma)}{1 - \tan \gamma \tan \delta}.$$

Making a similar reduction in the second member, we have

$$\frac{\tan \delta}{\tan (\delta + s)} = \tan (\gamma + \delta) \tan \gamma \frac{1 - \tan \gamma \tan \delta}{1 - \tan \gamma \tan (\delta + s)},$$

which, putting $s = 0$, and therefore $\delta = 0$, gives the vanishing ratio

$$\frac{\delta}{\delta + s} = \tan^2 \gamma.$$

Therefore, when s is small,

$$\delta (1 - \tan^2 \gamma) = s \tan^2 \gamma,$$

or

$$\delta = s \frac{\sin^2 \gamma}{\cos 2\gamma}.$$

We may therefore write

$$\alpha = \gamma + s \frac{\sin^2 \gamma}{\cos 2\gamma}, \qquad (12)$$

which is a very good approximation to α, being in fact the first two terms of the development of α in powers of s.

5. Now since α' corresponds to the actual distance X, of which x (to which γ corresponds) is the minimum value when s varies, α' is always greater than γ except when $s = 0$; and if α' were developed in powers of s, it would be of the form

$$\alpha' = \gamma + As^2 + \text{etc.}, \qquad (13)$$

containing no term of the first degree. Comparing this with equation (12), we see that for negative values of s, α' is further from α than γ is, and that when s is positive and small, α' is less than α, although for larger values of s it may exceed α.

Moreover, the employment of equation (12), which in all cases gives a close approximation, involves scarcely more labor, when a range table is used, than the finding of α', supposing x and s to be given.

The locus for which γ is constant is a vertical straight line. Equation (12) shows that α must increase and decrease with x in order to hit points on this vertical line. Hence if α remains constant, the abscissa of the point hit will decrease as s increases and increase as s decreases; that is to say, the locus of the point in which the trajectory cuts the line of sight is a curve cutting the axis of x at an obtuse angle. This is in conformity with the case of the unresisted trajectory, for which this locus is known to be a parabola with its axis vertical and cutting the axis of x again at the origin. See Ext. Ballistics, Meigs-Ingersoll, p. 15.

The hypothesis of the rigidity of the trajectory of course assumes this locus for a constant value of α to be a circle whose centre is at the origin, and it is possible that this circle may cut the true locus in a point above the axis of x.

6. As an illustration, I have computed the values of the angles considered above by means of Ingersoll's Ballistic Tables for the 100-pound 6-inch shell of standard form, fired with an initial velocity of 2000 f. s. to hit the point for which $x = 3500$ yards, $y = 500$ yards, the value of s being therefore $\tan^{-1}\frac{1}{7}$ or $8^\circ\ 7'\ 48''$. The results are as follows: Computing α by the method of §1, we find

$$\alpha_1 = 3^\circ\ 27'\ 42'',$$

and using this to compute ε, we find at first $\alpha = 3^\circ\ 30'\ 16''$, and recomputing ε, finally

$$\alpha = 3^\circ\ 30'\ 18''.$$

The computed value of γ (which we should find directly in a Range Table) is

$$\gamma = 3^\circ\ 28'\ 27'';$$

the value of δ is found to be $1'\ 48''$, so that equation (12) gives

$$\alpha = 3^\circ\ 30'\ 15''.$$

The value of α' is

$$\alpha' = 3^\circ\ 31'\ 24'',$$

which is greater than a, a result which, as indicated above, is rendered possible by the very considerable value of s.

As a second illustration, if the sign of y be changed, the other data remaining the same, so that $s = -8^\circ\ 7'\ 48''$, we have of course the same value of a_1, and computing ε, we find at once

$$a = 3^\circ\ 26'\ 40'',$$

which is unchanged by a recomputation of ε. The value of γ is the same as before, and δ has its sign changed so that equation (12) gives

$$a = 3^\circ\ 26'\ 39''.$$

The value of a' is the same as before, namely,

$$a' = 3^\circ\ 31'\ 24'',$$

which is now far out of the way.

The value of β in the computation was taken as unity, although this mean value is recommended by Siacci only for the horizontal range. We are as yet, so far as I know, without a method of correcting β when the range is not horizontal. It seems, from an investigation of these special cases, that in the first example β should be increased possibly to 1.008, and in the second example possibly to 1.015. The result would be to increase a at the most 40″ in the first case and 1′ 15″ in the second case.

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TARGET PRACTICE.

By LIEUTENANT J. F. MEIGS, U. S. N.

The object of target practice is to accustom men to their weapons, and make them skilful in their use. It may be said that the ends in view are (1) to train marksmen, and (2) to train tactical bodies of men. The butt-firing, of which we hear so much, has for its object the training of marksmen; it is sought to find out to what degree of nicety the eye and nerves of men, who have special natural skill, can be trained by firing under conditions of great simplicity. No one believes that the members of the rifle-teams could show anything like the skill they exhibit if they were, with two or three other men, crowded around a gun-port, and firing at a moving object in the water. For such work, butt-training alone is not sufficient.

The firing of tactical bodies, such as guns' crews, ships' whole batteries, ships' riflemen or boarders, companies, etc., if conducted under circumstances which are like those which may occur in service, will fall in accuracy far below butt-firing. But though the firing at the butts will not alone make men good shots in the more difficult circumstances, yet it is not useless. Indeed, in any numerous body of men, the simpler form of firing must constitute a large part of the training given.

Here is the right place to say that it is impossible to train men in pure marksmanship with anything but small arms. To use guns of the larger classes is too expensive. A round from an 8-inch B. L. R. costs about $66, from a 6-inch about $34, from a Hotchkiss 3-pounder $3, and from a shoulder rifle about two cents. The object then of the great-gun quarterly allowance is not to produce marksmen, or, to put it in a way which will be more readily accepted, this is a small part only of its object. The men who pull the lock-string may

become more expert marksmen in the course of a cruise, but the improvement will not be great. No one would be satisfied, in an attempt to become a good shot, with some ten or eleven shots per annum for three years. The object of the great-gun allowance is, after drill has perfected the training of the men as much as possible, to perfect the work of (1) the gun's crews and (2) the ship's battery. The gun-captain should have shown some fitness for his place before he is put there, and he and the other members of the crew should thoroughly learn their duties in loading, pointing, and firing a gun before they are allowed to handle it loaded.

Since skill in throwing their weights in the proper direction no longer tells as much as formerly in gun's crews, the old drill has lost some of its importance, or rather, it need not be so often repeated. It is as important as ever that guns should be rapidly and surely handled, but this end will now be attained in other ways than it was. It is dreary work to run guns in and out every few days through a whole commission; and as soon as a crew has learned to handle the gun surely at top speed, the running in and out and fictitious loading should be repeated only often enough to keep up the skill attained. To sum this matter up, it may be said that it is a pity that all drill of gun's crews cannot be target practice. By using sub-caliber bores in the gun, a large part of it can be made very nearly like target practice, and by excluding at drill everything not found necessary when actually firing the gun, we may invest the drill with an interest it does not always possess.

The consequences of the fact that the gun target allowance cannot make the gun-captains marksmen are numerous. Target practice with great guns should not be conducted without attention to the gun's crew as a whole. If a gun is allowed to be loaded in a leisurely manner, and some person ordered to aim and fire it, the mistake has been made of not attending to the gun's crew. The drill should be enforced during target practice. For, leaving out the matter of providing for safety, the object of the drill is to produce rapid and effective use of the gun, and if it will not do this it should be changed.

Here the point may be made that all tactical firing should be on time. There can be no doubt that such firing when executed in battle will be on time, and, therefore, it should be on time from the beginning when preparation is going on. If a single gun's crew is firing continuously at a target, or a body of riflemen are doing the

same, it is not advisable to push them into firing wildly in an attempt to fire a great deal; but they should be pushed to fire as fast as they can without loss of the accuracy they can attain to in very deliberate practice. Under ordinary circumstances, and when well mounted, a gun of medium weight can be as well pointed, probably, in 30 seconds or less, as it can be in any greater time. One of the points that officers should note in target practice is the degree of excitement of the men. If they are too much excited, some steps should be taken to restore quiet.

All tactical firing should, then, be on time, and men should be pressed to fire as fast as they can while having a proper regard to safety precautions in loading, and to the balance and steadiness of the man pulling the lock-string.

Although the argument that all firing in battle will be on time, and that our practice with tactical bodies is a direct preparation for this, may be held to be sufficient to establish the rule that we should note the time elapsed in all firing of tactical bodies, yet a word may be added as to the importance of rapid fire. Sea-fights of former days were won within point-blank range—that range for which, with the guns and targets present, there was no need to know the range—and it is the belief of many that sea-battles will always be fought within point-blank. At such ranges, speed in serving the gun is of very great importance. The gun may be kept pointed all the time, and the lock-string pulled as often as a load can be put in. Then, too, the volume of fire must be made as great as possible; all guns must be fully supplied with ammunition, and the riflemen open, if the target is at about half the point-blank range of the great guns. Guns must at such times be worked at full speed with comparatively few men, and those spared from the crew must aid in passing ammunition, and open fire with rifles.

It is doubtful whether in all men-of-war of recent times as much ammunition can be passed to the battery as can be effectively fired at a target close aboard. It would be an interesting point to note regarding the stationing of ships' companies at general quarters, how great a weight of shot (from calibers of all classes) could be kept up per man per minute for a short time. The duration of such a trial must be made sufficient to test the supply of ammunition. If, under such circumstances, the ammunition cannot be supplied fast enough, measures must be taken to overcome this. There can be no doubt that, at the very short ranges which occurred in former

times, the successful ship usually drove her enemies to cover—or to a fancied cover—causing a slackening of fire, and at the short ranges which will again occur the same thing will happen. If, as is by many believed, the principal part of sea-conflicts will occur at short range —ranges which, when referred to the point-blank of guns, our true tactical unit, will not be longer than in the days of Benbow—if such be the case, the *number* of bullets we fire, together with some regard to their direction and penetrating power, will be all-important. We might try to put a shot from a 50-ton gun through our opponent's bottom at close range, but unless the 50-ton gun were protected much better than is usual, it could not be reloaded under the fire of 100 ½-ton guns, and its crew had better be put at some more useful work while the range is short.

If it be true that much firing at sea will be at distances extending not far beyond point-blank range, it follows that most of our target practice should be similarly conducted. Under such circumstances, the gun must be very rapidly served, everything being sacrificed to hitting the target a large number of times.

It is essential to the success of any scheme of target practice intended to be applied in a military organization, that, among other things, the environment of the individuals of the organization be carefully studied. Armies, having usually better facilities for improving the skill of individual marksmen at the butts than have sea forces, will probably always excel the latter in butt-firing with hand rifles. We cannot in the navy, from the circumstances of our ordinary peace service, pass a great deal of time in training individuals in this way. But, as has been mentioned, this seems to be the only way in which the marksmanship of a numerous body of men can be materially improved, and we must, therefore, resort to it as much as possible. An attempt is now being made to establish at each receiving-ship a school of marksmanship depending principally upon the use of the rifle and revolver. In order to make these thoroughly efficient, much must be done in the way of building ranges and procuring other facilities, elaborating suitable and progressive forms of training, etc.

The great difficulty experienced on board these ships is the want of ranges. In the case of the receiving-ship at New York, where, from the large number of men passing through, a range is most needed, the circumstances are most unfavorable. But this difficulty will probably be overcome, either by the erection, at considerable

expense, of a covered range within the limits of the yard, or by arranging to send the men in drafts to some point where a range can be built more cheaply. At the navy-yards in Boston, San Francisco and Washington, at which latter place the seaman-gunners are held, very fair ranges have been secured; and at Norfolk, which in importance is probably second to New York, a range over which reduced charges may be fired is in use.

Another difficulty under which the receiving-ships labor is the very uncertain time that men are held on board them, some being retained for a few days only. It thus becomes necessary to give men their practice as soon as may be after coming on board, and the embarrassment in arranging and putting into effect a good scheme is much increased.

The details of the plans to be adopted in each receiving-ship are, by order of the Navy Department, at present left to their commanding officers, it being required that they shall classify into four classes, and being provided that men, upon transfer to cruising vessels, shall receive an award diminishing from $2, according to the class in which the man stands. It is also provided that, by an entry in the transfer papers, the skill of each man shall be shown. The firing is with rifles and revolvers, and the score depends upon the results of firing with the two. This plan is now in operation. The facilities for its convenient and efficient execution are some of them wanting; but in its main outline it is now carried out, with the exception of New York, where the expense which must be incurred cannot at present be met.

Whenever proper facilities can be had at each receiving-ship, the methods of firing can be made the same at all; but meanwhile each commanding officer uses the best method he can arrange with the facilities to be had. The men then come to cruising-ships classified in marksmanship with the rifle and revolver, having had an award paid to them depending on the degree of their skill, and with the same marked on their transfer papers. These marks are carried along in each man's record for every quarter during his enlistment. The marks and the award for each quarter are the same as already referred to for the time of transfer from the receiving to the training ship. The only record made or report sent forward regarding this firing, is the entry in the man's papers. The scheme here outlined is described at length in Order 14 of the Bureau of Navigation, of July 20 last.

There is thus provided and in actual operation a plan by which enlisted men are classified in both receiving and cruising ships, and by which their records in shooting rifles and revolvers are carried with them. The plan is also carried out in the training service. The receiving-ships, though all dividing their men into four classes—not counting those who fail to classify at all—arrange the details of the firing by which men reach the several classes, in the best manner possible with what they have at command; but cruising ships, while having the same four classes and the same awards, to be paid quarterly when firing occurs, have all the same requirements for reaching the several classes. The firing in the cruising ships is with rifles and revolvers, and is from either a ship or a boat.

This scheme, so devised that it may be generally applied and at the same time sufficiently elastic to allow ships whose opportunities are very different to compete, cannot fail, if elaborated in accord with the dictates of experience, to improve the shooting of most men in the navy. It is true that some of our men do not remain long in the service, but others do for considerable lengths; and any plan, if it serves no better purpose than to teach us that it is bad, must result in good. The theory of naval training should contemplate the conclusion of certain parts of men's education when they go on board cruising ships. Our men should have some use of fire-arms before going afloat.

One trouble is the great multiplicity of fire-arms and weapons generally which our men must learn to handle. And when, to the skill in caring for and using these, is added the complexity of drills intended to provide for all cases which may arise, it appears that a good deal is necessary. Still, there must always remain some similarity in the care and use of fire-arms; and, if the drill-manuals be reduced to the smallest compass possible, not more, perhaps, than most men can master will remain.

By the means now in use, the records of all enlisted men in firing with rifles and revolvers are obtained, and are always carried with them. At two or three of the receiving-ships, some firing with boat guns has been undertaken; but this, because of its cost when extended to a large number of men, must be limited in its application. On board the Dale, where men are training for the rate of seaman-gunner, an excellent and well-equipped range 1000 yards long has been built, and here the men are required to shoot at frequent intervals. When the Alarm is prepared to add to this, and to

the varied experience the men get in the shops in handling ordnance material, some firing with 6-inch and 3-pounder rifles, we shall have the ideal gunnery school. It will remain only to use the facilities to good purpose to produce results which will commend themselves to everybody.

In this statement of the conditions of necessities for target firing on board the receiving-ships, the advisability of including for the men on board them some drill should not be overlooked. All knowledge of service drills which may be possible should be acquired by men in receiving-ships. The men at New York, where facilities for target practice are so unfortunately wanting, pass through very complete schools of drill—sighting exercises, and firing with parlor rifles—and at the Washington yard, the men training for the rate of seaman-gunner are taught all service drills. These last, from the fact that they have all, or nearly all, previously to their stay on board the Dale, been petty officers, and because they go back to the same rates, are very carefully taught the service drills. We need in the navy a numerous body of men well trained in gunnery duties, and the outlook is promising that the school at the Washington yard may be able to furnish these in sufficient number, and with the degree of skill and permanency of stay which we need.

The scheme of practice in marksmanship which has been described extends to every officer and man on board ships of the navy. Four classes of marksmen are provided, and commanding officers may pay stated awards to persons in the several classes. Incidentally, the history of the marksmanship of each enlisted man is obtained and goes with him. By such a plan, if it stands the test of time, the general skill of the navy in shooting will be improved, and the means adopted of training men in firing their pieces immediately upon enlistment will ensure us that all men in cruising vessels know something of the use of the weapons put in their hands. The matter of the practice of ship and boat guns is not touched upon here. This comes afterwards, and will be improved by the better skill of the masses, so to speak.

Before leaving the matter of the instruction of individuals in marksmanship, attention may be called to the fact that recruits should be taught to handle and fire their rifles and revolvers before they spend much time on other parts of the military drills—the stations in gun's crews, facings, marchings, etc. The seaman side of a man-of-warsman is left to grow with his surroundings, and as his natural bent

may incline. His military training is undertaken by his divisional officer. And certainly among the first steps in the work should be to put a rifle into his hands, and let him learn how to use and fire it. A man who is afraid to fire his gun is as useless as one who does not know how to face to the right, or what to do at the order "Cast loose and provide." It is true that, for one opportunity to let a man fire his gun we have in the navy a thousand to tell him to face to the right, but the plea is here made that we must get the opportunities which do not exist.

The matter of the practice of gun's crews, riflemen, boarders—that is, tactical firing in general—is now provided for in an order of the Navy Department of date July 31 last. The firing of guns is marked by cross-bearings in the horizontal plane, and of boarders and riflemen by counting the shot-holes in targets of stated size. Prizes are given as commanders-in-chief of squadrons direct, and authority to rent rifle-ranges is granted. The only limitations as to the kind of great-gun firing selected by any ship are those necessary to secure the possibility of recording the practice in the book of Record of Great Gun Target Practice. It is thus possible to select in each ship the kind of firing which will be most useful to the crew, and prizes may be paid to gun's crews as soon after the firing as the record can be made up. For some quarters in the years 1889 and 1890, all the gun's crews in the navy competed for prizes under the same rules; the records were sent to the Navy Department, there to be made out, and the resulting standing, together with orders awarding the prizes, finally published. The objection to this way of doing is that all ships, however long in commission and whatever their needs, fire under the same circumstances, and that awards can be paid only after the lapse of months in some cases. The plan now in use, and the former one, have their advantages and disadvantages. Other plans have been proposed, as laying down what a ship shall do in each of the twelve quarters of her commission, establishing an annual competition on the same rules, while leaving all other quarters open to be decided by each ship, etc.

Attention may here be drawn to the danger that any scheme of target practice may do more harm than good. They always run the danger of becoming too refined and elaborate; but this feature, though causing unnecessary labor and trouble, does not prove that a plan is a bad one. The plan is bad only when it is less good than what would be adopted by the persons in charge if left to themselves.

But in order to ensure some degree of fairness and efficiency in the use of the appropriation for gunnery exercises, now voted by Congress, all ships of the navy must have certain points of resemblance in their target practice. The great point is that they must have a record, and that this record and the manner of getting it must be sufficiently accurate for the purpose in view.

This brings us naturally to the matter of recording the firing of guns. All other than that of boat and ship-guns is recorded by observing the shot-holes in targets of stated make; these being either regulation targets of the army or specially designed ones. The fall of shot from ship and boat-guns, in the case of both stationary and moving practice, is recorded by observing the points of fall in the water to the nearest degree or half-degree, by observers placed on lines which intersect at right angles at the target. The instrument used by the observers is called a T-square; and consists of an apparatus resembling a T-square, carrying a number of vertical wires at about 36 inches from the eye. The aperture between each vertical wire subtends, at the observer's eye, an angle of one degree.

The most natural and in many respects the best way to record gun-practice is to have targets sufficiently large to catch all shots we are interested in knowing about. Thus a canvas screen representing the broadside of a ship might be used. The T-squares fail to give us the side-errors of guns, as will be mentioned again further on, and this a large target would do. They would cost a good deal, as they would frequently be broken; but this is a matter which probably can be provided for. The principal difficulties in the way of the use of great-gun targets are two in number: (1) they must be stored at certain places, and ships must go there to use them, and (2) if made large enough to catch a large fraction of the shots fired by a moving ship when in a seaway, they must be very high and unwieldy. The English use a gun-target 20 feet high, but the circumstances of the run by it while firing render the distance-finding very simple, and the practice is consequently accurate. If a target 20 feet high only is used, and the circumstances of the firing are made difficult, the record of many shots will be lost.

There is no reason why the two methods should not be used: the large canvas screen, and the observation of the points of fall in the water. If a more accurate instrument than the T-square could be found, a great step would be made. But the circumstances of its use must be kept in mind. It must be held to the eye in a boat in a

considerable seaway, and must give the points struck by shots as fast as the observer can talk. The instrument must be read while at the eye. It is necessary in some gun-practice to have a number of guns firing, in order to cause familiarity with the noise and smoke. The use of photography has been proposed, and some attempt to use it been made. The T-square gives us with accuracy what we most want—the range-error. The ammunition for the main and secondary batteries of the Newark at her first target practice will cost about $3000, and so large an expenditure should be made with care.

The accuracy of the T-square is such that, admitting an error of one degree in the observation of the point of fall, the shot is placed, in the horizontal plane, when the observers are 1000 yards from the target, to within 17 yards. This limit is sufficiently close so far as the range-errors of guns go, but is wholly insufficient with regard to side-errors, because the side-errors of guns are much less than this. In other words, if we have observers, provided with T-squares, over a gun which is firing at a target 1000 yards distant, and abreast of the target and 1000 yards from it, we shall be able to place the shot to within 17 yards of its position in range and sideways. And, because the ordinary errors of guns afloat are in range much greater than this and sideways much less, the accuracy of the determination is sufficient in range, and insufficient sideways. In other words, if the horizontal diagram is plotted by appropriate means into the vertical plane through the target, the position of the shot-points vertically is practically correct, while their side position has no value. In truth it depends largely upon the liberal or illiberal nature of the observer stationed in the plane of fire. To offset this deficiency, the determination of the side position of the shots is not very important, because the side-errors of guns are usually well within the side dimensions of targets, while the reverse is true of range-errors and the heights of targets.

Some important consequences flow from this. The desirability of plotting gun-practice into the vertical plane becomes questionable, because the side position on the target in this plane has no value; and the plan now adopted in service diagrams, of giving equal merit to shots falling anywhere in horizontal belts extending indefinitely both ways, is justified. The complications arising in plotting the practice of stationary guns into the vertical plane are not great; but if a ship moves freely about in front of a target, while firing at

it, the difficulty of getting the record so that the firing may be plotted into the vertical becomes very great. And there is an objection, too, to plotting stationary practice into the vertical plane and leaving the moving practice in the horizontal; this being that the diagrams made at the two kinds of firing are not then readily comparable. The difference between the two is that in the moving practice the range is known and communicated only by methods which would ordinarily be available in battle, while in the stationary firing the range is always known. The moving practice is always less accurate, and for this the distance-finding arrangements are responsible.

The record of gun-fire, besides being kept in the book of Record of Great Gun Firing, is sent to the Navy Department, where it is plotted. The records of all ships are sent to every vessel in commission; there having been issued in this way within the last year two pamphlets, containing 52 sheets showing the practice of main battery guns alone, and containing, together with the names of the gun-captains firing each shot and their average time of serving the guns, a record of nearly 2000 shots.

The book of Record of Great Gun Target Practice is intended to enable a ship to keep throughout her commission a record of all her target-firing with ship and boat guns. The book is turned in to the Navy Department when the ship goes out of commission. It was first issued October 1, 1889, and is accompanied by explanations of its use. It consists of a series of sheets conveniently ruled, and arranged for plotting in the horizontal and vertical plane. The scale in the horizontal sheets is one inch to 80 yards, and in the vertical ones one inch to 20 feet, and, to plot from the horizontal to the vertical plane, trajectories of all the guns on board are furnished. These are drawn on transparent paper, so that they may be superposed on any diagram; and their horizontal and vertical scales are the same respectively as those of the horizontal and vertical sheets in the Record Book. Their coefficient of distortion is thus 12, and this, while giving a convenient form to the trajectory, enables us in using them, by an entirely graphical process, to plot from the horizontal into the vertical plane.

There will shortly be printed a series of tables, computed by Ensign Haeseler, which will make plotting into the vertical plane less laborious than it now is by the use of the transparent trajectories just described. These will enable us, by entering a table with the reading of a T-square abreast a target, to state immediately how much above or below the water-line of the target the shot passed.

Thus, by two orders of July 20 and 31 last, certain schemes of target-firing are set in motion. The first deals with individual rifle and revolver firing of all officers and men in the navy, both in cruising and other vessels. This firing is recorded only in the men's papers, and excellence in it is stimulated by the immediate payment of an award. The second deals with gun practice, and that of riflemen and boarders. The reports of this are sent to the Department on blanks issued for the purpose, and the firing of ship and boat guns is recorded in a book retained on board the ship until the end of the cruise. Prizes for this class of firing are paid upon the order of commanders-in-chief of stations.

A question which arises here is whether all this firing can be combined; whether a reasonable scheme for combining firing of different kinds may be devised, so that men who exhibit skill always may be specially rewarded. The following, for example, is a case of a man who showed skill in several particulars:

1. In the third and fourth quarters of a certain year he qualified first-class under the rules for individual firing with rifle and revolver. On the first occasion only 2 men in the ship's company reached first-class, and on the second 12.

2. In the third quarter of this year he reached a merit of 100—the highest possible—while firing a 37 H. R. C. at 1000 yards range. No other gun-captain of the ship reached as high a merit on the day in question.

3. In the competitive firing of all the first gun-captains in the navy, in the third quarter of the same year, when firing the 60-pounder B. L. Parrott, he reached ninth place among the 61 gun-captains competing. On this occasion he was again the first among the gun-captains of his own ship.

Numerous cases similar to the above might be quoted, and have suggested that, if a plan by which each man in the navy should keep his score, or by which the scores of men in different divisions should be kept, a body of men skilful in the use of all kinds of fire-arms might be developed. The difficulties in the way of getting a satisfactory plan are many, as the weights to be assigned to accuracy in the use of different weapons must be arbitrary at present, and must be so even in the use of the same weapon under differing circumstances.

The development of good captains for the guns of ships would, of course, be a principal object in such a scheme, but that success in

this respect would be reached is by no means sure, for it does not follow that a good shot will make a good gun-captain. It appears reasonable that, from among the men who are recognized as the leaders in a ship's company, those who have a good record with rifles and revolvers should first be tried as gun-captains.

The machinery which now exists provides for getting, and does get, the record of all classes of firing in our ships, and from it may be obtained the record of any man we please; but if this record lay more on the surface than it does now, officers of ships would probably be aided in stationing men to the best advantage, and we might recognize more clearly than we can now, a class of men who are more valuable to the service than is generally believed.

On July 1, 1889, money for the payment of prizes or awards for excellence in target practice and gunnery in the navy, first became available by congressional appropriation; and, from the steady pressure which the continuance of this fund will cause, it may be expected that our plans of conducting and recording target practice of all kinds will improve. The system now existing in the army, for small-arm practice, has been some ten years in growing to its present condition. In these ten years, plans of organization at posts, such as building and equipping of ranges, appointment of officers necessary to do the work, etc., have all been put on foot. And, in Washington, suitable and steady appropriations of the money necessary have been secured. Some of these details have yet to be arranged with us, but if the officers of the navy as a body want things not now existing for the prosecution of target practice, they can get them. They may at first be refused money which is considered necessary, or may be unable to see how the organization of time and labor, which is necessary, is to be reached; but all these things will come in a few years if the matter is adhered to.

The fund for prizes and awards is more important than is at first realized. Not only does it apply a direct stimulus to skill in marksmanship, but, requiring as it does for its proper expenditure a *record* of firing and an examination of results attained, the indirect interest aroused is very great. The naval service expended in the fiscal year ending June 30, 1890, about $1000 in awards for good marksmanship, which was at about the rate per capita of the army expenditure during the same time. The amount of money thus put afloat, or the money value of the badges, if these are used, is small; but the interest indirectly aroused in marksmanship, very great. In the navy, the

practice of giving awards in money has been adhered to. The usage in military and naval services differs in this respect, some giving money and higher rates, while others give honorary badges. The question has hardly come up with us as yet, because, until our schemes have further crystallized, it is better to give money, which establishes no classes or other precedents, and thus admits of changes as deemed expedient. In our army, badges made at the U. S. Mint are sent to successful competitors upon a proper certificate; while in the English navy, money prizes are used. It may here be added that there is much less complication caused by the use of money prizes, particularly when the prizes are to be awarded on board ships widely scattered.

The above has been written largely with the view of eliciting the views of officers of the navy. Besides the various points which may be suggested by what has been said, an expression of opinion as to the plotting of great-gun target practice is hoped for. Should it all be plotted into the vertical plane, should the stationary practice go into the vertical plane and the moving remain in the horizontal plane, or should all remain in the horizontal plane?

It is better, since the targets which we are to fire at are vertical, to put it all in the vertical plane. But the complications which this will require are very great, unless an approximation, presently to be described, is adopted. If it is all left in the horizontal plane, a less clear image than is attainable is given; and if part is in the horizontal and part in the vertical plane, the stationary and moving practices are not readily compared. When firing at 1000 yards range, the two observers locate the shots in the horizontal plane to within about 17 yards as a maximum error; and, in the stationary firing, the shot-points are strung out in a long line, while, in moving practice, unless the run is directly towards or away from the target, the shot-points are sprinkled all around the target. The position of the ship with respect to the target must be known for every shot, both in distance and azimuth, if we are to plot into the vertical. These data can be obtained, but the complication will be great. There is one way out of it. This consists in assuming that all shots in the moving practice are line shots; or, what is the same thing, assume that the distance from the centre of the water-line of the target to the point they strike is a range-error—measure the hypothenuse erected on the range and side errors and call this the range error.

The difficulty of knowing the azimuth of the firing ship for every

shot is thus got rid of; but the range, which also is necessary to plot into the vertical, is still known imperfectly. For this the range given the gun may be used; but if this has been determined by estimation, the diagram resulting has not much value. There can be no doubt that the errors in distance-finding by other than good instrumental means are considerably greater than the range errors of guns at ordinary ranges. Thus the method of plotting just described presents grave errors in certain cases—errors which must be considered inadmissible. In cases where ships fire at a target under circumstances in which they cannot themselves determine the range by instrumental means, a boat suitably placed might determine their range at each shot.

Another point of great interest and importance, incidentally raised by the examination of great-gun target diagrams, is the marking and use of sight-bars. Since in some cases of firing at a moving ship from a ship which is herself moving, the continuous motion of the sight-bar in its sleeve, if it is kept rightly adjusted, will be visible to the eye, it is very important to bring this matter down to its simplest form and systematize it. The usual method is to set the bar at the distance communicated, aim at the water-line of the target, and fire. This, unless we presuppose some excitement or rapidity of work to cause coarseness in the sighting, will drop one-half of the shots into the water short of the target. The Bureau of Ordnance is now considering the fitting of a central sight on new guns, to be called a "battle-sight." As this sight cannot be very long, the greatest range attainable when using it will be in the neighborhood of 2000 yards; its first mark will be at about 800 yards—this will be its mark when down; and the steps by which its marks proceed will be longer than those on the side sights.

The whole matter of the marks put on sight-bars, the step which they proceed, the degree of coarseness of the sight to be taken, and the use of the bars generally, should be as simple and as widely understood as possible. It should also be as nearly the same in weapons of all classes as may be. The subject is very complicated, but it is suggested that, in ordinary firing at sea, the following rules should apply:

1. The gun should always be aimed at the water-line of a target.

2. The bar shall be marked for each range, so that, when aiming as directed in Rule 1, the shot will pass five feet above the water-line of the target.

3. Sight-bars shall not be capable of being lowered below (?) yards.

4. The marks on sight-bars shall proceed by large counts, as indicated by the degree of flatness of the gun and by a target (?) feet high.

5. All great-gun sights shall be put on coarse; they shall be as nearly as possible of the same pattern, and the distance between them shall be as great as it can be made.

6. Divisional officers shall carefully watch men when firing, and shall, at times of excitement or when the ship's motion is sharp, lower the bars by suitable amounts.

DISCUSSION.

Lieutenant J. C. WILSON, U. S. Navy.—The paper on "Target Practice," by Lieutenant J. F. Meigs, offered for discussion, deals with one of the most important matters affecting the final efficiency of war vessels.

Other things being equal between two combating vessels, success falls to the one whose battery is served and fired with best effect. So vital a point is target firing in the drilling of crews that too much attention cannot be paid to it, providing, of course, that other necessary points be not neglected.

The question of rapidity and accuracy of firing the arms with which a man-of-war is armed is the consummation of the whole ordnance question as applied to guns. It matters not how good these may be in themselves, if they are not served and fired with good results in time of action; so that in bringing up for discussion the question of how best to obtain these results, Lieutenant Meigs has placed the service under an obligation to him.

It is a melancholy fact, known to every officer of the service, that until recently but very little attention was given to target practice, which was conducted on no system at all; and it is fully time that this be changed.

There is no question but that the "recruit" should go on board a cruiser a fairly good marksman, and to become this, opportunity for practice must be given him. For this and other reasons I advocate a year's preliminary instructions for every "recruit" in *barracks*, where ample facilities and opportunity could be found; such instructions to comprehend all gunnery as well as other drills. This year should be an extra one, that is, if the regular enlistment (or rather re-enlistment) is made four years, as it should be, the first (or recruit-enlistment) should be made five.

Sufficient facilities for the training of men should be supplied every naval (barrack) station. A more advanced school of instruction might be established at Washington, for the special instruction of those considered worthy to qualify as gun-captains, seaman-gunners, torpedo-men, etc.

Assuming that this has been provided, and systematic instruction in the use of all arms has been given each recruit during his year of preliminary training, he should step on board a cruising ship with a record which would show how mcuh he was worth as a gunnery man.

In connection with any plan or system which may be adopted to perfect our crews in gunnery, systematic records and incentives are of prime necessity. Without these, no scheme would give the best results.

The method of recording must be left to those whose study and experience in this direction have better qualified them than I feel myself or the average naval officer to be; but it would seem that, for purposes of comparison, stationary and movable firing should be plotted in the same manner, and of the two planes, the vertical would be the more graphic, or at least show the more important errors. Accuracy in firing of course includes horizontal accuracy, but such errors are not nearly of as much importance as are vertical ones, and if a practical working system to plot *both* cannot be devised, let us make sure of the vertical ones at all events. It is comparatively easy to learn to fire "in line," but not so as to elevation.

As the writer remarks, it is neither practicable nor necessary for any man to fire enough service-charges to *acquire* skill as a marksman.

Sub-caliber bores are very useful in this connection, and should be used more constantly. The greater part of the time spent by the crews at the guns should be devoted to theoretical and practical instructions in pointing and firing, the sub-caliber bores being used for the practical part.

Vessels on stations should rendezvous at least once a year at some convenient port, where suitable targets should be kept, and competitive firing take place under the same conditions.

I see no reason why the system of medals and money prizes should not be combined, each medal carrying with it a certain money prize.

There might be as many medals as there are classes of arms, and in addition, one for general excellence in firing with all classes.

There would then be:

1. Medal for excellence in revolver firing.
2. " " " small-arm rifle firing.
3. " " " secondary battery firing.
4. " " " main battery firing.
5. Medal for general excellence in firing with all classes of arms.

Values to be given for firing with the different classes of arms would have to be determined, as they should not all have equal "weight" in determining "general excellence." This last medal should carry with it a much larger money prize than any of the others.

A more general and systematic scheme of perfecting our crews in target firing should be adopted, and one which would not only enlist the interest both of officers and men, but also make it a matter of honor and profit to excel in "target firing."

Any system is better than none, as experience will suggest improvements, and it is to be hoped that the interest Lieutenant Meigs has taken in this important matter will lead to good results to the service.

Lieutenant W. F. FULLAM, U. S. N.—The most important and practical subject within the range of naval science is that of target practice, because the proper system of training and discipline for men-of-wars-men must be based

upon the same principles that govern the development of good gun-captains and good marksmen—the principles that win naval battles.

In demonstrating so clearly that marksmen cannot be developed by great-gun target practice alone, owing to its necessary limitations, Lieut. Meigs calls attention to the great importance of small-arm practice, a subject that has been sadly neglected and underrated. Every navy-yard should have a range —some kind of a range—where men could practice with revolvers and with rifles, using reduced charges for the latter, if necessary. This is perfectly possible. Even at New York a detail from the crew of the Boston fired at a target every day for several months, and the results were excellent. Reduced charges, a short range, and targets proportionally reduced in size, were used; but the principles of aiming could be taught quite as well. The cost of providing such ranges would be trifling. Thousands upon thousands of dollars are annually expended upon objects which, in comparison with target practice, have an insignificant bearing upon the efficiency of the navy. Ships have been known to remain for months in port, or at a dock, and not a man has fired a revolver or a rifle! The most important feature of naval routine was thus ignored.

To insure uniformity in small-arm practice, whether in the case of a single ship or a squadron, one or more officers, with petty officers to assist, should be appointed to superintend the practice, provide and keep the targets in order, and do the scoring. Divisional officers should have nothing whatever to do with such details, but should see that their men aim and pull the trigger properly, and that a spirit of rivalry is encouraged. If men never see their target records, if no comparison of results in different divisions or in different ships is ever made, if one bulls-eye is eight inches in diameter and another gradually grows to a diameter of sixteen inches, if when a shot strikes the paper target four or five pasters fall off and the divisional officer selects a hole at hap-hazard or takes the one nearest the bulls-eye in scoring, the men will lose interest, there will be no enthusiasm, little improvement in marksmanship, valuable opportunities will have been lost, and the only result is an expenditure of time and ammunition—that is all. But if, as Lieut. Meigs advocates, a uniform system is followed throughout the service, and records carefully kept, compared, and published, great interest can be aroused among the men, and they will soon be made to feel that the skillful use of weapons is the most important requirement.

It does not always follow, by any means, that the best shot under dress parade or peace conditions should be a gun-captain. Of two men, the one who is the poorer marksman at target practice may be the better in action. Personal characteristics—coolness and pluck—may decide which of the two will be most likely to hit a target that is hitting back. For this reason the man himself, as well as his target record, must be studied before making him a gun-captain. The qualities that enable a man to control other men will, as a rule, be the qualities that will enable him, with proper instructions, to become a fair if not a first-class marksman, provided he has good eyesight. A man who is by nature a leader of men will probably be a good gun-captain and a good marksman in action. This quality of force in handling men is very necessary

in great-gun practice. With small arms the man has the weapon entirely under his own control. In the case of a great gun, however, two or three other men assist in pointing; the men at the elevating and training gear must be controlled by the gun-captain. If the latter is a man of force who is respected by the crew, he will inspire obedience and attention, and his chances of hitting the target will, for this reason, be better than with one who cannot command the respect, attention and confidence of others.

The proposition to have one man to aim the gun and another to control the crew, is not a good one. It is perfectly possible to develop a class of men who can do both, and thus avoid the danger of "too many cooks." A gun-captain in the navy must be a man of force and intelligence, and a fair marksman as well. No system should be accepted by naval officers that will not meet this requirement.

The point made by Lieutenant Meigs, that target practice with great guns alone must not be depended upon to develop marksmen, emphasizes the necessity of resorting to every means of instruction that will tend to this end. Pointing-drill is an excellent way to train marksmen. Nearly all great guns have two sets of sights. Let the officer keep his eye on one set and the gun-captain on the other. If a primer is used, the officer will know if the gun-captain fires at the right instant. By constant practice, whenever the crew has great-gun drill, the men will improve wonderfully in aiming. Every man in a gun's crew should, in turn, be permitted to aim at a moving target. In this way every man will see how necessary it is that the men stationed at the elevating and training gear should obey the gun-captain implicitly and watch him constantly. Otherwise the gun-captain can never get his sights on the target. If each man has personally noted this fact, he will be more careful himself at the training or elevating gear. This pointing-drill, using primers, will also enable the officer to note if the gun-captain pulls the lockstring steadily, and if he keeps *his eye on the sights when he pulls*. Not only will men be greatly improved by this exercise, but it may serve to demonstrate that a man is totally unfit to be a gun-captain. If he is nervous, excitable, and nags the crew without controlling them, he is not the proper man for the place. This exercise, better than any other, will reveal a man's strong or weak points.

And Lieutenant Meigs is right in saying that, at target practice, men should be taught to fire rapidly—not wildly, but rapidly. This is a rapid-firing age. All but two or three of the heaviest guns of modern battle-ships and cruisers are of the rapid-firing type. What is the use of a rapid-firing gun if it is not fired rapidly? What is the use of firing rapidly unless the piece is aimed rapidly? And it is impossible to aim and fire rapidly if the loading is not rapid, and this cannot be done unless the men have been taught to do it rapidly at target practice—the only time when charges are used. Evidently the whole crew, not the gun-captains alone, must be trained with great care. And if this result cannot be attained at target practice alone, it must be sought in the pointing-drill. This pointing-drill can be practiced alongside a dock or at anchor, as well as at sea; better, in fact, because, as a rule, there are always moving objects in sight at which to aim. In this, again, the time in port or at a navy-

yard should not be wasted. Instruction with great guns and small arms can be kept up to great advantage.

The argument that at the first target practice after a ship is commissioned the firing should be slow, is not sound. It displays its own weakness and the weakness of our system of naval training—or lack of system. As Lieutenant Meigs says, "the gun-captain should have shown some fitness for his place before he is put there, and he and the other men in the crew should learn their duties in loading, pointing, and firing a gun before they are allowed to handle it loaded." "All knowledge of service-drills which may be possible should be acquired by men in receiving-ships." "Recruits should be taught to handle and fire their rifles and revolvers before they spend much time on other parts of military drills." These conditions and requirements are all possible, even now. If every man has not been taught to aim a rifle before he comes on board a cruising ship, there has been neglect somewhere. The day after he enlists he should be taught to aim a rifle, resting it on a sand-bag so that a petty officer can verify his aim. After being taught, the first day to aim, the recruit should fire at a target the second day. It has been shown that a range, for reduced charges at least, is possible at every naval station. Thus a recruit should not have been three days on board a receiving-ship without firing a rifle.

And before a ship has been three months in commission, before the first target practice, every crew and gun-captain should have been thoroughly instructed in pointing, first at fixed and then at moving targets, first deliberately and then rapidly. As the day for target practice approaches, the crew should be exercised in all the motions of firing six rounds as rapidly as possible, bringing ammunition to the gun, using primers, and the gun-captain sighting properly. Then it would not be necessary to fire slowly at the first target practice. The reasons for doing so are necessarily based upon the assumption that previous instruction has been neglected, and that proper care has not been observed in selecting gun-captains. Such objections can be removed, and the few shots fired from great guns should be fired rapidly to secure the best results.

The pointing-drill and rapid firing will make one thing plain to a careful observer, that the men to handle rapid-firing ordnance efficiently must have the military habits of attention, exactness and obedience, and this requirement should govern modern naval training.

In discussing the necessity for some uniform system of target practice, Lieutenant Meigs is right in saying that "a plan is bad only when it is less good than would be adopted by the persons in charge if left to themselves." It is not possible that any plan could be "less good" than no plan at all. The idea is to establish uniformity in the navy, and arouse among officers, petty officers, and men a spirit of rivalry by comparing the skill of different divisions and different ships and rewarding those who win.

It is evident, however, that to reap any substantial benefit from target practice and instruction in marksmanship, the men who have become good gun-captains must be induced to remain in the navy for some time at least. If instruction is to be without system or thoroughness; if gun-captains are to be appointed with little care; if there is no permanency in their rates, and if they

leave the service soon after they become efficient, we have, in our naval routine, simply a wear-and-tear upon ships, a wear-and-tear upon guns, a wear-and-tear upon the patience and zeal of officers and men, and no result that tends to prepare a navy for war.

Lieutenant KOSSUTH NILES, U. S. Navy.—The interesting paper of Lieut. Meigs gives assurance that the important question of target practice is receiving a careful and systematic consideration. If much of the practice heretofore during a cruise has been of a perfunctory nature, it has been due, perhaps, as much to the want of a definite system of rewards for good shots, as to the lack of interest resulting from no uniform method of marking and keeping permanent individual records. As the allowance for great-gun practice is necessarily small, the few shots permitted should be made with the utmost care, to determine not only the skill of the marksman but the efficiency of the gun under the favorable conditions of deliberate service. To perfect the working of the gun-crews, and at the same time afford an excellent opportunity for improving the marksmanship, I think Mr. Meigs' suggestion as to sub-calibers is excellent. All division gun-drill, or most of it, can be made of the nature of target practice by using sub-caliber bores. Each gun could have its own target; and, there being a certain number of shots allowed, the rapid service of the piece at point-blank range would afford a practice approaching partially the conditions of using service charges and projectiles; the pointing would be practically of the same nature if either the vessel or the target was moving, and this condition should be obtained in using sub-caliber bores. The drill complete should be enforced just as if service-charges were in use. It is not likely that there will be any undue excitement during target practice, especially with sub-calibers, and therefore a certain amount of excitement should be encouraged, for without it there can be no vim and no definite amount of quickness. Rapidity of fire will certainly be all-important.

The plans set forth for classifying, rewarding, and keeping the individual records of the enlisted men, appear to be well devised under the present facilities. As soon as the methods of firing can be made uniform at the several stations, the value of the classification on the receiving-ships will be increased. On cruising ships the plan ought to produce a gratifying improvement in the marksmanship in small-arm practice.

An annual competition in tactical firing, the records to be sent to the Department, appears to me to meet the desirability of a general competition of all cruising ships. With regard to the plotting of great-gun practice, I think it would be desirable to plot all shots in the vertical plane, as we obtain one point of great value in knowing the position of the shot with reference to the water-line although the position sideways is in error. The complications arising from the additional labor and data required may be reduced by the use of tables; and as the interest in the practice is increased, some better instrument than the T-square may suggest itself, thus reducing the range error.

Commander C. M. CHESTER, U. S. Navy.—While agreeing with the lecturer in the main on the great importance of the subject under discussion, I differ

with him on one or two points. Particularly would I advise against the "time" element in a target-firing exercise. Of course, of two vessels equally well-drilled in precision, the one firing the most shots at an enemy will do the most injury, but it is very questionable to my mind if perfection in one of these branches does not detract from the other. In no class of work that I know of is the old saying of "hurry makes flurry" so applicable; and officers will in battle spend more energy in trying to keep the petty officers from throwing away shot in rapid firing, than in urging the crew to quick action. The whole tendency at such a time is for rapidity of motion, and the crew that has been best drilled in the details of loading and firing will in the end gain the best results.

In target practice the captain of the gun is alone to be marked. If time enters as a part of the record, his standing depends, not upon his ability as a marksman, but first upon the handling of the gun by the crew; second, the handling of the ship by the commanding officer; and, above all, upon the handling of the vessel by the natural elements. The gun-captain has no chance to improve his time, for, at best, he has but three or four shots during a practice, and his mark must rest on other qualifications than his own. The question of aiming a gun in a seaway with the ship underway is not one of pointing in 30 seconds or less, but of laying the gun so that when the proper moment arrives it may be fired to hit the object.

The lecturer states that "if they (the men) are too much excited, some steps should be taken to restore quiet." What else can be done but to slow down? and another deduction from the score results. Furthermore, rapid firing is too expensive. In practice it is almost impossible, where men are working on time, to prevent shots following in quick succession, with the loss of record of one or more shots—thus $34 or $66 and upwards is thrown away, and sometimes the practice is at the expense of a man's life.

It has been my invariable custom, when directing practice of this kind, to urge and insist that the captains of guns should pay no attention whatever to the passage of time, but to fire with the greatest possible deliberation. I, of course, knew full well that the score would be reduced by this order, but felt that more than enough would be gained in precision to make up for it.

I also beg leave to suggest that, in my opinion, the record of target practice should only be taken from the vertical scale. It is necessarily plotted first on the horizontal scale, for none of the service targets are large enough to catch but a very limited number of the shots fired. It is not a difficult matter to transfer from the latter to the former, and the record as thus projected is easily understood by the men who work the guns. In reading the score from the horizontal projection, they must understand the nature of the shot's trajectory for the particular gun fired, before being able to comprehend the value of the practice.

I recall an instance in my own experience, to particularize. A shot fired from an VIII-inch rifle, by one of the best marksmen I ever saw, struck just outside the 50-yard circle, giving him but 50 per cent of the maximum mark. Another shot struck about 90 yards to the right and over the target, scoring the same. Plotted on the vertical scale, the first shot showed close to the

bull's eye of the target, while the second would have entirely missed a vessel of the size of the Galena. This latter shot was from a IX-inch S. B., and the discrepancy is due to the difference of the trajectories of the two guns. A third shot from a IX-inch gun struck about 50 feet from the center of the target, and short, gaining a perfect score (100) for the captain of gun.

I would here remark that while the T-square is not inappropriate for recording target practice, there are so many young officers who have had experience in observing horizontal angles in surveying as to make a finer register of this work practicable in most ships.

The side error should, in my opinion, always be observed, and with the sextant. It can be done either from the ship itself, or from the observation boats, by reading the angle from the target to the ship. If the horizontal projection is used for marking the value of the practice, it becomes necessary to have varying areas of equal weight for each class of gun, or the rifle gun will always be handicapped as against the old smoothbores.

Captain L. A. Beardslee, U. S. N.—The importance of the subject so admirably treated by Lieut. Meigs will undoubtedly so commend it to the thinking men of the navy, that there will ensue full and free expressions of views upon several of the points presented: and of the younger men of the service, many who have been favored with opportunity to gain personal knowledge from practical experience with modern guns on modern ships, will contribute valuable opinions founded upon their facts. There remains very little for one of the old school, whose knowledge of ordnance and cruisers is confined to a life-long experience with old-fashioned muzzle-loaders and wooden ships, plus the results of his study of the work of others, to justify him in entering into the discussion; but the references in the essay to methods and systems on board of recruiting-ships, by which some little knowledge of gunnery is sought to be imparted to recruits, prompts me to give a little in detail of the method in vogue on the Vermont.

During the year ending in September last, about three thousand men had passed into and out of my command, and our average number on board has been about three to four hundred. Some of these men have been with us but a few days, others for months. It seemed highly necessary that we should do something toward carrying out the Department's views, and we did our best, starting with obtaining a full outfit of the service-rifles and a wooden model of an 8-inch gun, and some revolvers, with all of which we thoroughly instructed the men in everything but firing. Situated, as is this ship, in the midst of a thickly populated town, it was simply impossible to fire a shotted gun of any kind, so we had to make believe a good deal.

Then we obtained some Quackenbush air-rifles, with which, on our spar-deck, we practiced considerably; but such practice did not have value enough to arouse a great deal of enthusiasm, especially as it was not considered that records made with this little gun were fairly comparable with those made with service-rifles of any kind. At this juncture, Lieut. Mulligan was seized with an inspiration and invented an apparatus which, starting with his own guard, be-

came excessively popular and useful. As this apparatus is very simple, and can be made and used in any ship with little trouble and expense and much profit, I will describe "Mulligan's gun."

It consists of a cylindrical log about four inches in diameter, about 12 feet long. At the exact corresponding position of the sights of a 6-inch and 8-inch gun are slots, into which, when in use, sheet-brass sights, fac-similes in profile to those of our service-rifles, are set when in use. A lock-string is fitted to the rear end: the gun is mounted upon adjustable legs.

With this apparatus the men were taught to sight at a movable disk (moved by another man and governed by signal from the firer). Each man was allowed three shots, and the result, as shown upon a white duck-covered target, soon developed considerable accuracy in sighting. It was noticeable that with nearly all of the sighting the three shots formed a triangle, the length of sides differing greatly, in accordance with the skill of the firer. To each triangle the name of the maker was affixed, and the system grew so popular that the men would ask for the gun when off duty, and eventually it was left standing for them to use when they pleased, and there was hardly an hour in the day that a group would not be found target-shooting for amusement, and the more skilled ones instructing the others. Cards, dominos and checkers were not so popular as Mulligan's gun.

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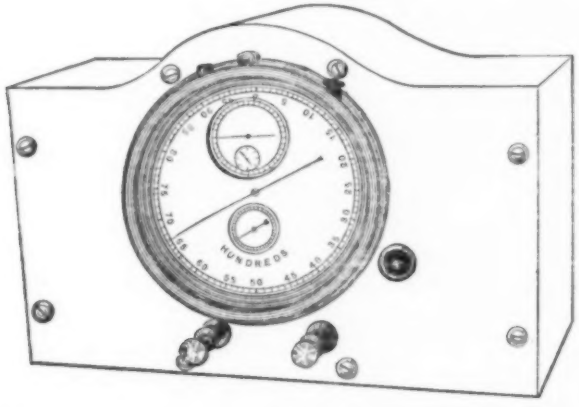
U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ELECTRICAL COUNTER, AND SHAFT REVOLUTION AND DIRECTION INDICATOR.

By W. D. WEAVER, Assistant Engineer, U. S. Navy.

During the frequent trials of steam launches and other fast-moving machinery at the New York Navy Yard, continual trouble was experienced with mechanical counters, and the electrical counter, an illustration of which accompanies this, was devised to replace the former.



It consists essentially of an electrical escapement in combination with a stop-timepiece. By turning the lever on the left, the time movement is started and stopped at exactly the same instant as the escapement, and thus we have simultaneously the time and number of revolutions. The other two projections shown are to bring the hands of the watch and counter respectively to zero.

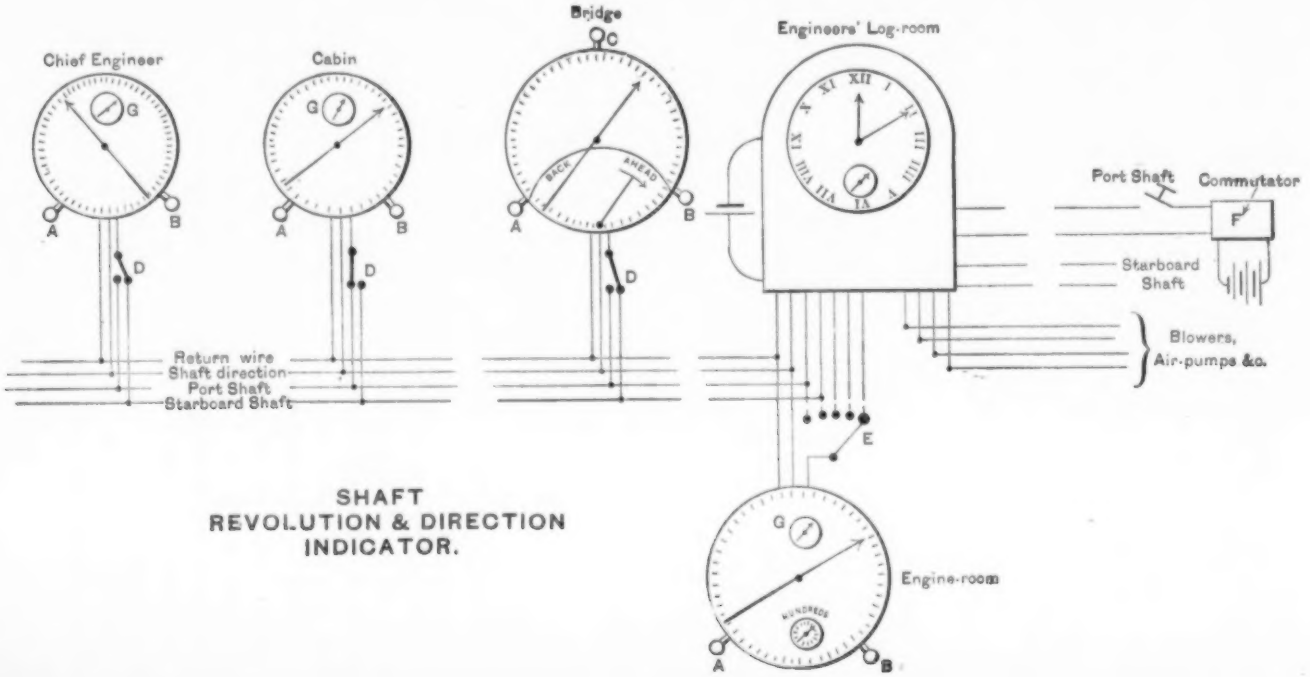
The counter has proved very useful in many ways, particularly in getting the slip of launch screws over a measured course. It could

be arranged aboard ship to take in succession the revolutions of the main and auxiliary engines by leading a wire from each to a switch at the instrument, which could be placed in the most convenient place. At the highest speed tried on a lathe, 1500 revolutions per minute, the counter proved to be accurate, not losing a revolution in over 10,000, as measured by a mechanical hand-counter attached before the lathe started and read after it had been stopped. It is probable that one can be made to work to several thousands of revolutions per minute; the present one was made from parts taken from a scrap-heap, and its success is largely due to the mechanical skill of Mr. J. S. Gordon of the New York Navy Yard.

The success of the counter demonstrated the feasibility of a revolution indicator which the writer has long had in view, and which has since been designed in all of its details but not yet constructed. The accompanying diagram shows the arrangement and general appearance of the revolution and direction indicator, and the essential principles are given in the following description:—

On each shaft of the main engines, and on as many auxiliary engines as desired, one or more contacts are made at each revolution, each of which sends a current to any register that is open to the circuit. On the shafts of the main engines is a simple form of commutator, *F*, by means of which the direction of motion of the shaft is also shown on the register. All of the shaft circuits are led to a clock, in connection with which is a device for changing from one series of circuits to a second one, and *vice versa*, at regular intervals of time. From the clock, circuits are led to as many registers as are desired, the number that can be put up being practically unlimited; four are here shown, one of which, that in the engine-room, having also circuits from the auxiliary machinery.

The method of working is as follows:—When a reading is desired, it is first observed if the direction-hand, marked *G*, is indicating; if it is, it will be necessary to wait an interval of time, the maximum of which is ten seconds, until it returns to the zero mark. When it is at the zero mark the button *A* is pushed in, and after another interval, the maximum of which is ten seconds, the revolution-hand begins to move and stops at the figure corresponding to the number of revolutions being made per minute, and remains there until *B* is pushed in, when it returns to zero ready for another indication. It is thus seen that before a reading can be taken, an interval of time between thirty and ten seconds is required; it is not necessary, however, to



SHAFT REVOLUTION & DIRECTION INDICATOR.

stand by the register, as, after the button *A* is pushed in, the hand will remain at the point at which it stops until returned to zero by *B*.

On the register for the bridge the direction-hand is made large and a lever *C* added, by means of which it may alone be kept in the circuit and indicate continuously as long as desired. To the engine-room register are connected in addition, by means of a switch, circuits from the various auxiliary engines, so that their revolutions may be taken singly or in succession when desired.

The ideal revolution indicator is, of course, one that will show at a glance at any time the number of revolutions the engine is making, but of all of these that the writer knows of or has imagined, none seems to be practicable or sufficiently accurate. On the other hand, the apparatus here described is positive in action and accurate, and, from the simplicity of its parts, little liable to get out of order.

PROFESSIONAL NOTES.

THE ORGANIZATION AND DUTIES OF TRIAL BOARDS FOR OUR NEW CRUISERS.

By Lieutenant J. C. Wilson, U. S. Navy.

The writer was recently ordered as a member of a trial board on one of our new cruisers, and remembering his hazy ideas concerning what his duties might embrace, believes that a discussion based on knowledge gained by him in the performance of this duty might prove interesting as well as instructive to officers who have not as yet had any such experience.

This discussion is not a description of any actual proceedings, but merely how, in light of my experience, I think that trial boards for our new cruisers should be organized, and how the trial should be conducted.

As thousands of dollars depend upon the result of these trials, and much rivalry and competition exist between contractors, it becomes very important that the results should be not only accurately determined, but that the methods of obtaining them should be as nearly identical in all cases as circumstances will permit. For this reason it would seem that, were a general order issued concerning the organization and methods governing the procedure of such boards, it would tend to uniformity of reports, and be of great assistance to the board in conducting the trials.

The precept accompanying the orders calls attention to the most important points to be determined, leaving the method of determining them to the discretion of the board. This may seem at first thought a very simple thing to do, but my experience convinced me that the method of conducting the trial of a cruiser should be well considered and planned beforehand.

It is important that the board meet and organize at the earliest practicable date, and organization and proceedings should be based on the rules governing "Courts of Inquiry."*

The orders and precept should be read and carefully discussed, so that no matters of detail will be left in doubt. All officers that have been connected with the construction or fitting out of the vessel to be tried, as well as the officers ordered to duty in anticipation of going in commission with her, should be invited to appear before the board and give the members the benefit of their knowledge and views concerning the vessel. The contractors, also, should be invited to appear, or send a representative for the same purpose.

Committees should then be appointed, and the senior members instructed that the report of their committees would be expected *before the vessel was ready* for her trial trip, in order that any serious defect or departure from contract, etc., could be known before her trial trip. It is possible, but not probable, that something might exist which would render it impossible to accept the vessel, even though she proved successful as to speed. It would probably be convenient to appoint four committees :

* Five members and a recorder (who need not be a member) would seem to be as large a board as convenient for working purposes. As many assistants as necessary could be ordered; but not counting work in engine-room, not more than eight officers will be required on deck; if no angles are to be taken, six will be enough.

1. To determine whether the vessel is sufficiently strong to carry armament, ammunition and all necessary stores. This committee should take charge of, and carry on tests for strength and manœuvring qualities, as hereinafter described.

2. To determine whether the hull and fittings are strong and well built and in accordance with contract, plans, drawings and specifications, and to duly authorize changes in the same.

3. To determine whether the machinery and appurtenances are strong, etc. (At least one member of this committee should be in the engine-rooms during the trial.)

4. To keep a record of all expenses connected with the trial trip.

Committees Nos. 2 and 3 will find their duties very comprehensive and requiring much attention. It involves, first, a close examination of contract, plans, drawings and specifications, and an overhauling of all correspondence relative to changes. The superintending naval constructor should furnish these committees with copies of the specifications, with all authorized changes entered, and with these for guides, the committees must find out, as far as practicable by investigation and inspection, whether or not the vessel is strong and well built and in accordance with contract, etc., and *duly* authorized changes.

Committee No. 4 should, as soon as possible, commence enquiries concerning the expenses connected with the trial trip, and to do this should require the contractors to furnish them with a pay-roll of vessel as ready for trial. They should ascertain how many persons are to go on the trial trip, and agree with contractors on a rate per diem for such persons; and *no others* should be permitted on the vessel during the trip. With the pay-roll, quantity and price of coal, list and prices of all necessary stores, rates per diem for subsistence, allowance for bedding, linen, crockery, etc., there would be no subsequent trouble about the expenses to be allowed. The reports of the sub-committees having been reviewed and discussed, the board is ready to proceed with the trial trip.*

If practicable, the vessels to take current observations should be in or near their stations at least one day before the trial is to commence. A day's practice in observing the currents would be beneficial. One should be anchored *exactly* on the range at one end of the course, and at a previously determined distance from the shore signal (about 100 yards inside of the line of the course), and the other similarly on the range at the other end of the course. Two vessels will be enough, as the steam launches of these vessels could be anchored on the line joining the two vessels, each ten miles distant from its own vessel. I see no reason why these launches could not be anchored in any water likely to be found on any trial course, and in any weather favorable for a trial trip. If the water was very deep, a wire and light grapnel could be used. The vessels and launches should make as much black smoke as possible, so as to serve as a guide for the vessel on trial to steer by during the run. If practicable, signals should be erected on shore at convenient distances sufficiently close and distinct for triangulating from the vessel during the trial run. The "range signals" should be particularly high and well defined. An accurate projection of the course, shore line and signals, on a good working scale, should be at hand. Three independent sets of observers should be detailed (each set consisting of two members), and stationed forward, amidships and aft. One observer of each set should observe when the vessel crosses the range lines, and the other to observe and record the times. There should also be one observer to keep an accurate record of the courses steered by standard com-

* It may happen that the contractors report the vessel ready before the preliminary work of the board is completed; but enough would have been determined to know whether the vessel could be accepted if successful on her trial, and the details left until after this trip. As a rule, however, the work of examination could be completed before the vessel would be ready for "trial," and as it is important that this should be so, the board should be ordered long enough in advance to make this practically certain.

pass, direction, force of wind, sea, etc. If the course is staked out along the shore by signals, as suggested, there should be two observers with sextants to angle on the signals, and so keep the course the vessel was making graphically plotted. The commander of the vessel should be cautioned to make a long enough sweep after crossing the second range to enable him to come on the line as near as possible where he crossed it. This is important, particularly on account of current effects. Accurate observations of wind and sea should be recorded. Each set of observers' record times of crossing ranges from their stations and the mean of the three time-intervals (corrected for chronometer rates) should be taken as the correct time-interval. Chronometers should be compared before and after trial.

As soon as the trial is over the board should meet to consider data. The length of the course has presumably been determined and officially reported to the board. The average strength and direction of current should have been signaled as the vessel on trial passed the current observers, so that a close approximation for current allowance could be made immediately after the run. It is a question whether or not allowance should be made for poor steering. Where the increase in the length of the course, due to poor steering, can be accurately determined, I am of the opinion that it should be allowed, as it does not seem just that the vessel should be credited with a less speed than she is known to have made. With care, and the course marked by the current-observing vessels, there should be no allowance necessary on account of broken course; but as a broken course may be made, the question of allowance should be decided by the Department and embraced in the "General Instructions."

Correction for Current.*

a, b, c, d, = strength of current per hour (reduced to direction of course), observed at stations during run of vessel with current.

a', b', c', d', = same during run of vessel against current.

Then $\frac{a+b+c+d}{4} = C$ = average strength of current per hour during run with current.

$\frac{a'+b'+c'+d'}{4} = C'$ = average strength of current per hour during run against current.

t = time running with current.

t' = time running against current.

L = length of course.

$t + t' = T$, total elapsed time running over course.

Then $t \times C$ = effect of current on vessel during run with current.

$t' \times C'$ = effect of current on vessel during run against current.

Then $L - (t \times C) = d$ = distance run over with current.

$L + (t' \times C') = d'$ = distance run over against current.

$d + d' = D$ = total distance run over by vessel.

As soon as the speed has been approximately determined, the representative of the contractors should be called in and informed of the speed made, and asked whether or not he was satisfied with the trial. If so, he should then be informed of the nature of the tests required, and requested to be ready for them at as early a date as possible.

In the meantime the fire and steam pumps should be tested, as well as the water-tight doors, valves, battle-hatches, etc. In fact, everything on the vessel which can be put to a practical test.

Being ready for steering gear and engine tests, the vessel should be put to

* Having corrected the length of course for current and steering, and ascertained the correct elapsed time, the speed equals $\frac{D}{T}$, $\left(\frac{\text{Corrected length of course}}{\text{Corrected lapsed time.}}\right)$.

sea, and the strength of hull, fittings, etc., be determined by inspection while under way, the following tests being considered desirable, not only to determine the strength of hull and fittings, but to demonstrate the manœuvring qualities of vessel.

First Set of Tests—(Steering Wheels, Helm, etc.).

A. With steam wheel in pilot-house. Both engines going ahead full speed (—— knots). Order "Hard-a-starboard." Time to put helm hard over (number of degrees). Time to complete half-circle. Time to complete full circle.

B. Ship still turning with starboard helm (full speed). Order "Steady," "Hard-a-port." Time to put helm hard over (number of degrees), during which the vessel fell off ——° to port, and started to go to starboard in —— seconds.

C. Steam wheel in conning tower. Going ahead with both engines full speed (—— knots). Order "Hard-a-port" and "Back starboard engine." Time to put helm hard over (number of degrees). Time for engine to commence backing. Time to complete half-circle. Time to complete full circle.

D. Steam wheel on quarterdeck. Going ahead full speed with both engines (—— knots). Order "Hard-a-starboard," "Back port engine." Time to put helm hard over (number of degrees). Time for engine to commence backing. Time to complete half-circle. Time to complete full circle.

E. Hand wheel on quarterdeck (number of men on wheel). Same as *A*, with time to change from steam to hand gear.

F. Steam wheel in steering-room. Same as *A*, with time to change from hand to steam gear.

G. Hand wheel in steering-room same as *E*.

Second Set of Tests.

A. Going ahead full speed with both engines (—— knots). Signal "Back." Engines commence to back. Vessel stopped (—— time), in a distance (number of yards), (distance to be ascertained by a chip-log with a very light line, which cannot possibly interfere with working of screws if caught). Engines backing full speed (time), (revolutions).

B. Ship backing full speed. Signal "Ahead full speed." Engines commence going ahead. Ship stopped (time). Ship going ahead (time). Engine going ahead full speed (time), (revolutions).

The trial of the vessel being over, the board should meet to discuss the report, the proceedings being governed by the rules for "Courts of Inquiry." The written report should give a full record of proceedings, and all data obtained, with conclusion of board. A list of work still remaining incompleted by contractors should be appended, and also the probable time necessary to complete the vessel ready to be accepted by the Government.

When the latter fact has been reported to the Department by the contractors, the board should be ordered to convene again to report whether or not the vessel was in every particular ready for acceptance.

The work of the board being completed, they adjourn *sine die* to await action of convening authority.

REVIEWS.

ALMANACH DER KRIEGS-FLOTTEN, 1891. With 134 cuts of armored vessels. Published by Mittheilungen aus dem Gebiete des Seewesens.

Part I. is devoted to tables of measures and weights, and reduction tables for the English and metric systems.

Part II. Artillery of the different fleets. This comprises tables of the details of all classes of great guns, projectiles, charges, initial velocities, striking energy, and penetration, including all kinds of ordnance in use in the navies of Europe and of the United States; Krupp guns, their construction and ballistic data; Armstrong guns of late construction; Canet guns; machine-guns; rapid-fire guns. These tables are revised and based upon the latest data.

Part III. List of vessels of the navies of the world, giving the dimensions, horse-power, armor, armament, speed, material, dates of launching; followed by 134 cuts of armored vessels. H. G. D.

DOMESTIC STEELS FOR NAVAL PURPOSES. By Lt.-Comr. J. G. Eaton, U. S. N. Printed in the Proceedings of the Society of Arts, 1889–1890, Massachusetts Institute of Technology.

The author begins with a short history of the steel manufacture in the United States, showing the marvellous development in the manufacture of domestic steels which has taken place within the last eight years, owing to the impetus received when Congress authorized the construction of our four first ships of mild steel of domestic manufacture.

A thorough account is given of the rigid inspection and various tests required prior to acceptance of material by the Government, the author dwelling at length upon this important feature. The use of steel in manufacture of boiler plates and stays, engines, anchors and chains, steel rigging, and especially in the construction of guns, is described, and the establishment of a high standard is shown to be the result of the Government inspection and requirements.

H. G. D.

RÔLE AND ORGANIZATION OF SEA-COAST BATTERIES. By V. Fabre, Captain, French Artillery. Translated by First Lieut. E. M. Weaver, 2d U. S. Artillery. Published by Artillery School Press.

The translation appears in a 62-page pamphlet. The subject is divided into three parts: Part I. Rôle and organization of sea-coast batteries, showing the influence of altitude on batteries from defensive and offensive points of view, and the distinction between battering and bombarding batteries. Part II. A general review of the development of marine armor. Part III. Defense of the sea-coast. H. G. D.

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VOLUME XVIII, Nos. VIII and IX. Late researches in oceanography (continued), by Captain C. v. Berman. Steamship companies and the auxiliary service.

An interesting article on the organization of an auxiliary service. The writer, in view of the fact that in time of war fast merchant steamers will be called into service as transports, supply-ships, and armed cruisers, dwells upon the necessity of a thorough organization, on the importance of contracts between the steamship companies and the Government, of the payment of subsidies. He advocates that in the construction of merchant steamers attention be paid to details in view of the ulterior purpose for which they will be used in time of war—armament, equipment, and supplies to be ready at all times; officers and crews, how to be selected; steamship companies to form auxiliary bureaus under the Government; establishment of depots.

Lessons from the English fleet-manœuvres, by Vice-Admiral C. Mayne, R. N. Electricity on war-ships, by S. Dana Green. The spontaneous ignition of coal cargoes, by Prof. Vivian B. Lewes. On the under-water launching of automobile torpedoes in the line of the keel, and on some pending questions regarding torpedoes, by Julius Heinz. The Chinese navy. Budget of the royal and imperial navy for 1891. Floating of the Lloyds steamship Arciduchessa Carlotta. English protected cruiser Blenheim. Japanese cruiser Tschiyoda. Coast defenses of the United States. The English armored ship Sultan. Alterations in the new cruiser-type Centaur. The Victoria torpedo. Trials with a torpedo-cruiser of the "Turnabout" system. Official trials of the submarine boat Peral. Libbrecht's smokeless powder. Late trials of the Brennan torpedo. Test of the armor-plates of the Chilian man-of-war Capitan Prat. A Swedish hydrographic expedition. Steamer Oriel of the Russian volunteer fleet. Unsuccessful attempts to fire dynamite from ordinary guns.

VOLUME XVIII, No. X. Late researches in oceanography (conclusion). Incidents and phenomena attending the release of compressed air, by Dr. P. Salcher. Launching of the Austro-Hungarian torpedo-ram Kaiserin Elisabeth. Contracts for the new armored and protected cruisers of the United States. Trial trip of the U. S. S. Philadelphia. Institution of torpedo companies in Russia. Tests of Schneider plates. Introduction of semaphores on English vessels. A new steam life-boat. On submarine vessels. Holmer's collision-cloth for stopping leaks. Duinker's boat-hoisting device. List & Dick's compound propeller-blade. E. Berg's engine-room signalling

apparatus. Alarm belt-cable for the protection of men-of-war at anchor. The submarine boat Peral. The English torpedo-depot vessels Vulcan and Hecla. Association technique maritime. Stipulations for the delivery of steel tubes. Trials of the Sims-Edison torpedo. Deep-sea dredge. Use of oil in smoothing the sea. Prizes for best method of using oil in smoothing the sea. Employment of balloons in the French navy. Signal communications between men-of-war and merchant vessels.

VOLUME XVIII, No. XI. On lighting of coasts, by A. Frh. v. Koudelka. Smokeless powder.

An interesting view of the probable effect of smokeless powder on naval warfare. Fleet engagements in which non-smokeless powder is used are compared with those in which the smokeless powder is the agent, and the comparative advantages and disadvantages are brought out. The importance of concerted action, fleet tactics, and skilful manœuvring is enhanced, mere chance playing a minor part. The "bataille rangé" will be the result. The effects on the action of torpedo-boats, combats between cruisers, and attacks upon coast or harbor defenses are also discussed, and the whole question is treated in such a lucid and interesting manner as to suggest vital changes in naval battles of the future.

Tests at the steel works of F. Krupp with the 29-cm. howitzer. Budget of the French navy for 1891. Budget of the Swedish navy for 1891. Budget of the Danish navy, 1890 to 1891. Experiences of naval warfare, 1860 to 1889. The French cruiser Le Cécile. Firing tests against a captive balloon in Russia. Boat-davits, Rees. Improvements in the dynamite gun. Manipulation of water-tight doors in the United States navy. Budget of the Norwegian navy, 1890 to 1891. Boiler tests of torpedo-boats. The Giffard rifle. Experiments with cordite. Launch of the Spanish cruiser Infanta Maria Teresa. Experiments with a captive balloon in the German navy. Classification and naming of the men-of-war of the United States. Launch of the English tug Asp. Triple-screw cruiser for the United States. Rules for ships' boilers.

VOLUME XVIII, No. XII. The English and French fleet manœuvres, 1890, by Ferd. Attlmayr. On the requirements of ocean steamers, especially as regards their machinery, by J. Fassl. Competitive armor tests in America. Reorganization of the artillery and torpedo bureaus in France. The defense of Paris by floating batteries. The Victoria torpedo. Electric motors for rapid-firing guns. Japanese coast-defense vessels, type Itsu Rusima. The Chilian torpedo-gunboat Almirante Condell. About the Turkish navy. Literary notices: The coast and courts of Asia, by Lieutenant L. v. Jedina. European armies of the present times, by Hermann Vogt. H. G. D.

ABSTRACT OF THE PROCEEDINGS OF THE SOCIETY OF ARTS, 1889–1890, MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Biological water analysis, by Prof. W. T. Sedgwick. The history and theory of cohesive construction as applied especially to the

Timbrel vault, by Mr. Raphael Guastavino. The kriegsspiel as practiced in America; its object and place in military science, and its relations to military and naval manœuvres, by Major W. R. Livermore. The history and theory of cohesive construction as applied especially to the Timbrel vault, by Mr. Raphael Guastavino. The development of magazine-guns for army use, by Capt. A. H. Russell, U. S. A.

A short history of magazine-guns, and enumeration of the magazine-guns in use, with 22 cuts.

The physical properties of iron and steel at higher temperatures, by Mr. James E. Howard. Combination voltmeter and ammeter for electrical measurements, by Mr. Anthony White. Domestic steels for naval purposes, by Lieut.-Comdr. J. G. Eaton, U. S. N. (400th meeting, 1890, February 27). The application of storage batteries to street-car propulsion, by Col. E. Hewins. Experiments with alternating currents, by Prof. Elihu Thomson.

ANNALEN DER HYDROGRAPHIE UND MARITIMEN METEOROLOGIE.

18TH ANNUAL SERIES, VOLUME I. Influence of the velocity of the wind on dimensions of ocean waves, by Dr. C. Börgen. Determination of deviation of the compass by observations of the sun, moon, or other heavenly bodies, without knowledge of time, latitude, declination, variation, or even of the heavenly body observed, by F. Sohnke. Report of Captain C. Green of the German bark Elizabeth, voyage from Allas Straits to Isabela, Isabela to Manila, Manila to Sunda Straits. Taudjong Priok. Exceptionally heavy squall on southeast coast of Africa. Report of Capt. G. Schumacher of the German bark Augustina, voyage from Newcastle, N. S. W., through Torres Straits to Saigon. Currents, temperatures, and specific gravity of surface water in Gulf of Aden. On currents in Chinese waters, by Captain P. A. Polack. Wind velocities on German coast. Minor notices: Description of a waterspout; Current observations in North Atlantic ocean; Remarks on the Bay of Ambrizette, west coast of Africa; Landmarks for Angra Pequena; Remarks on Mongoli, Roumania, Black Sea; Trip of a twin-screw steamship across the Atlantic with one screw; Bottle-post from Sophie and Nixe.

VOLUME II. On classification of chronometers. Sailing directions for entering Cameroon river. Extracts from the log of Captain Deeken, schooner Sagterland; the Roccas; the bar of the Rio Grande; the harbor of Macáu; voyage from Macáu to Rio Grande do Sul; Porto Alegre. Report of Captain Albrand of German bark Emma Römer; voyage from Indian ocean to Macassar. Soundings off the west coast of Africa. Soundings in Atlantic ocean, about the West Indies. The winds at Keitum, Island of Silt. Contributions to the history of meteorology. Minor notices: Use of oil for quieting the sea, tried on board H. M. S. Iltis; Floating buoys on west coast of North America; Ice on northwest coast of Alaska; Piloting at Sulina, Roumania. Tables.

VOLUME III. Contributions to navigation in the neighborhood of the Marshall and Gilbert Islands, by Commander Credner. On the approaches to the mouth of the Congo River. Extracts from the log of Captain Hansi of the bark Levuka. Daily changes in the deviation of the compass caused by solar heat. On the forms of cyclones (with plate), by E. Knipping, of Tokio. Quarterly weather review. Measurements of velocity of winds at different heights. Minor notices: Use of oil in quieting the seas; Sailing directions for Port of Spain, Trinidad; Obstructions in the Northeast Passage, Canary Islands; Passage of Sombok Straits; Bottle-posts from different vessels.

VOLUME IV. Remarks on the sailing directions for the China seas, by Captain Ascher of H. M. S. Iltis. Remarks on navigation in the Bismark Archipelago; Lord Howe and Solomon Islands. Extracts from log of Captain Reinicke of the bark Triton, on harbors in Australia and New Zealand. The volcanic island Falcon of the Tonga group. Sailing directions for the Bissagos Islands. Oceanography, observations in the North Sea. Soundings in the Indian Ocean, Bay of Bengal, and in the Pacific Ocean (Coral Sea). Quarterly weather review (continuation). Minor notices: Meteorological reports from the log of Captain Leopold of the bark Wega; Currents off the coast of Dalmatia and Montenegro; Harbor improvements in the island of Corfu; Depths of water in the harbor of Port Mula, Virginia Islands; Remarks on the harbor of Santos, Brazil, and on Ceiba, Honduras; Currents off the island of Upolu, Samoa; Banks of Manpango, South China Sea; Bottle-posts from different vessels.

VOLUME V. Report on the new American charts, gnomonic projections, for great-circle sailing, by Dr. G. D. E. Weyer. Remarks on the inland sea of Japan, and on Hakata-Fukuoka, Kiusiu, by Captain Ascher of H. M. S. Iltis. Extracts from the log of Captain Henne of the bark Papa; meteorologic conditions in Punta Arenas; the Baker Island in the Pacific Ocean. Sailing directions for northeast coast of Emperor William's Land, for the Los Islands, and the Dubreka River (west coast of Africa). The north coast of Alaska, between Point Barrow and Mackenzie Bay. Rain-fall on the Samoan Islands. Minor notices: The anchorage of Conakry, Los Islands, Senegambia; Harbor improvements in Buenos Ayres and La Plata; Sailing directions for the harbor of El Portillo, Cuba; Remarks on Makalleh, Gulf of Aden; Anchorage at Cochin; The Paracel Islands; Anchorage in the harbor of Amoy.

VOLUME VI. Hydrographic observations on the west coast of Africa, on a voyage of H. M. S. Hyäne from Capetown to Cameroon. Remarks on the east coast of Africa between Mafia channel and Kipumbwe reef, from the log of H. M. S. Schwalbe, Captain Hirshberg. On some ports on the coast of Costa Rica, by Captain Gille. Sailing directions for the north coast of Emperor William's Land (conclusion), and for the harbor of Memel. Ice in the North Atlantic

in the spring of 1890. Quarterly weather review (10 charts). Minor notices: On the use of oil for quieting the seas; Currents off the coast of Dalmatia; On the anchorage in Valle Malaluka, Dalmatia; On the anchorages of the island Merak, Java; Straits of Sunda; Reefs and anchorages at Sumenep, southeast coast of Madura Island; Sickness after eating fish. Tables and charts.

VOLUME VII. Studies on the effect of the moon on the weather, by Dr. G. Meyer. On various bays and harbors of the Samoan Islands, by Captain Herbing of H. M. S. Sophie. Report of Captain Bruhn of the ship J. Steffen, on the voyage from Guayaquil to the Gulf of Tehuantepec, with remarks on Rosario and Guelagichi. Description of the Kermadec Islands. Soundings in the North Pacific Ocean, off the west coast of America. Meteorologic observations in the roadstead and harbor of Cameroon, 1888 and 1889. The West Indian hurricane of September, 1888. Minor notices: On the effect of oil on the seas; Prizes for experiments with oil in smoothing the seas; On currents in the Bay of Biscay; Remarks on the Bay of Independencia and Port Permejo, Peru; Remarks on the islands of St. Matthew and St. Lawrence, west coast of Alaska; On a tedious voyage from Singapore to Anjer; Bottle-post from different vessels.

VOLUME VIII. The winds at Keitum, Island of Silt, by Dr. H. Meyer. Remarks on the harbors of Apia, Saluafata, and Pago Pago. The west coast of Africa between Wadi Draa and Cape Juby. Soundings in the North Pacific. Report of the thirteenth series of competitive tests of chronometers at the German observatory, 1889–1890. A new method of proving storm predictions, and results of the storm predictions on the German coast in 1889, by Dr. W. J. Van Bebber. Quarterly weather review, spring of 1886 (conclusion). Minor notices: On the use of oil for quieting the seas; Changes in the currents of the Indian Ocean; Current off the southeast coast of Nipon, between Yokohama and Oösima; Remarks on the Gulf of Patras, Ionian Sea; Remarks on La Guayra, Venezuela; Harbor improvements of Puerto de la Plata; The harbor of Quellon, Chili; The establishment of the correct geographic positions of several places in Chili; The non-existence of the Wolverine bank and Vibilia rocks, between the Tonga and Kermadec islands; Bottle-post from H. M. S. Sophie.

VOLUME IX. Observations of H. M. S. Sophie in the Bismarck Archipelago. Report of Captain Fesenfeldt of the iron bark Auguste, on his voyage from Shields to Sta. Rosalia (Lower California), and to Astoria and Portland (Oregon). Remarks on the settlement of St. Michaels, and the Stuart and Port Clarence islands, Alaska. The Comora Islands. Navigation of the lower Seine. The storm of April 25–26, 1890, by Dr. W. J. Van Bebber. Determination of magnetic elements at forty stations in northwestern Germany (extract). Minor notices: Use of oil at sea; On the locust swarms of the Red Sea; On the relative levels of waters bounding Europe; Sailing directions for Port au Prince, Cuba; Determination of longi-

tudes of Puerto Plata, Santa Ana, La Guayra; Remarks on various places on the west coast of Africa; Decrease of depths in Whale Bay, Africa; Position of islands off west coast of Zealous Island, Baker group, Patagonia; Remarks on islands in the Straits of Magellan; Haberton harbor and Beagle channel, South America; The roadstead of Panama; Salaverry, Tumbez river, Buena and Mejillones coves, in Peru; Darwin Channel and several harbors in the Chonos Archipelago, Chili; The breakwater at Colombo, Ceylon; Cyclones on the west coast of India and in the Arabian Sea; Swatow; Matautu and Savai, Samoan Islands; Newly-discovered islands northeast of Sunday Island, South Pacific, northeast of New Zealand. H. G. D.

DEUTSCHE HEERES ZEITUNG.

NOVEMBER 15, 1890. Ammunition supply in the French army.

NOVEMBER 19. Ammunition supply in the French army (continued). The ballistics of the Lebel gun. Electric signalling apparatus for ships.

NOVEMBER 22. Proposed changes in tactics. Ammunition supply in the French army (concluded). Direction indicator for ships. Launch of the Russian men-of-war Gangut and Hong-Hudd.

NOVEMBER 29. The French territorial army.

DECEMBER 3. The French territorial army (continued). Budget of the fleet, 1891 to '92.

DECEMBER 6. The French territorial army (concluded). River and air torpedoes.

DECEMBER 10. Firing drill for field artillery.

The launch of the '25. de Mayo' at Elswick:

A speed of 21.237 knots with 9000 H. P. was attained, and 22.43 knots with forced draft, and 13,800 H. P. developed. Coal capacity, 600 tons.

DECEMBER 13–17. Krupp's firing tests. What shall we do with Heligoland?

DECEMBER 27. The cruiser Le Cécile. The cruiser Infanta Maria Teresa.

JANUARY 1, 1891. Open letter on the fortifying of Heligoland, by R. Wagner.

JANUARY 3. The German auxiliary cruisers.

The estimated number of auxiliary cruisers of the Triple Alliance is 32, of which 19 belong to Germany, being vessels of the Hamburg-American Packet Co., and of the North German Lloyd, with tonnages ranging from 4000 to 10,000, speed from 18 to 20 knots. The intended armament for each auxiliary cruiser is eight 15 cm. guns, four 12.5 cm. guns, two 8.8 cm. guns, two 56 mm. R. F. guns, six revolving cannon, eight Gatlings. The vessels are to carry 115 rounds for the 15 cm. guns, 210 rounds for the lighter calibers, 1200 rounds for R. F. and machine-guns, besides two torpedo-launches and eight torpedoes.

The auxiliary fleet of Italy at present consists of eight steamers, of tonnage from 1046 to 4826, and 16 to 18 knots speed. Armament of each, two 12 cm. and four 3.7 cm. R. F. guns.

The torpedo-boat question.

A short review of the torpedo question, with an enumeration of the torpedo-boats of Germany and France. Germany possesses 6 division boats (250–350 tons), 48 Schichau boats (abou' 37 tons), to be increased to 60; 8 Vulcan, 6 Weser, 2 Thornycroft boats, besides 7 others. France possesses 9 torpilleurs de haute-mer (over 100 tons), 14 first-class torpedo-boats (60–100 tons), 83 second-class boats (40–60 tons), 41 third-class boats (20–40 tons), 6 torpedo-launches of less than 20 tons; total, 23 cruising or sea-boats and 130 coast-defenders. Attention is forcibly called to the manifold advantages of torpedo transport vessels of the English Vulcan type, of about 7000 tons, 21 knots speed, well armed and carrying 8 second-class torpedo-boats, fully equipped for service, which can be launched by means of steam cranes in a few minutes. Owing to the seaworthiness and high speed of such vessels they can keep up with the fleet at all times, in any weather, which cannot be said of the torpedo-boats. Heretofore, when long sea-voyages have been undertaken by torpedo-boats, there has always been more or less anxiety evinced, and their safe arrival looked upon as an event. When carried on a large transport vessel they are safe, and will reach their destination in greatly less time without exhausting the crew. The Tyne accompanied four Yarrow boats on a trip from Plymouth to Bermuda recently; the trip took 25 days. The Vulcan, carrying twice the number of boats, can make the same trip in eight or nine days, and with crews fresh and ready for action.

The tactics in action for the torpedo-depot and transport vessel will probably be to remain outside of the mêlée, having the boats ready, the commander deciding when and where to attack the enemy. Rather than take part at once in the engagement, it will be safe to await a favorable moment to make a decisive attack, the point of attack being communicated to each boat and everything directed from the depot-vessel; two boats to be kept in reserve. The objective point of attack being settled upon, the boats are sent out, with instructions to return, if possible, after carrying out the attack. Of course, each boat-commander has authority to take advantage of opportunities offered for other operations, but it must be borne in mind that the operations can be much better determined upon and directed from the torpedo-depot vessel than from the closed boats, especially as she takes up her position outside of the mêlée. The vessel is the refuge and depot of the boats. They return to her after the action, or when their ammunition is exhausted. The two boats in reserve are close at hand to lend aid to any hard-pressed vessel, and to protect their own vessel against an attack by one of the enemy's protected cruisers. England is building three vessels similar to the Vulcan, but other nations have not yet made the experiments.

JANUARY 7. Establishment of military telephone stations. Stations of the English fleet in 1890. The present fleet of Portugal.

H. G. D.

FRANKLIN INSTITUTE JOURNAL.

DECEMBER, 1890. The product of the Eureka Tempered Copper Company. The manufacture of tin plate. A new theory of the propagation of waves in liquids.

JANUARY, 1891. Electricity: its past, present and future. The continuous girder.

JOURNAL OF THE ASSOCIATION OF ENGINEERING SOCIETIES.

SEPTEMBER, 1890. The electrical transmission of power.

OCTOBER, 1890. Photography applied to surveying.

THE STEVENS INDICATOR.

OCTOBER, 1890. The fabrication of 12-inch mortars. Water analysis to determine scale-forming ingredients. Notes on the action of lubricants. A comparison of cut-off gear and link motion. Tractive force in the locomotive. J. K. B.

THE ENGINEER.

VOLUME XX, No. 9. Progress in aluminium. The process of steam in its development of power. Overheated furnace-crowns. Safety valves.

No. 10. The trial of the hydraulic-jet boat Evolution. Steel castings. Cylinder condensation. Reports of engine performance.

No. 11. Yarrow's water-tube boiler. Aluminium. Lubricating oils. Safety valves.

No. 12. Coal endurance of cruisers. Resistance of ships. Hydraulic tests for boilers. Triple-screw propulsion.

VOLUME XXI, No. 1. Lubrication of steam cylinders. Errors in boiler testing. Cylinder condensation.

No. 2. Heat transmission in boilers. Tests for olive oil. Forced draught. J. K. B.

THE ENGINEERING AND RAILROAD JOURNAL.

OCTOBER, 1890. Electrical transmission of power. The new fast cruiser.

An illustrated description of the new swift cruiser of 7300 tons, officially known as No. 12.

Steam lines across the Atlantic. The development of armor. A new variable blast nozzle.

NOVEMBER. The launch of the Maine. Electricity in daily life. Friction and lubrication of journals. United States naval progress. The Army Ordnance Notes. The submarine mine and torpedo in harbor defense. Description and drawings of the engines of the triple-screw cruiser No. 12.

JANUARY, 1891. The new geodetic survey of France. The new cruiser Tschiyoda for the Japanese navy. Our navy in time of peace. J. K. B.

INSTITUTION OF MECHANICAL ENGINEERS.

The Research Committee on marine engine trials. The report upon trials of three steamers, Fusi Yama, Colchester, Tartar. J. K. B.

MECHANICS.

NOVEMBER, 1890. Electrotechnics, a compilation of rules, tables and data. Pumps and pumping machinery. The theory of centrifugal governors.

DECEMBER. The Serve boiler tube.

A compilation of the results in a comparative trial of two boilers of same general dimensions, one fitted with the Serve tubes and the other with the ordinary tubes. The results show a gain in evaporative capacity of from 11.2 per cent to 16 per cent in favor of the Serve tubes. The tubes fitted were of steel in both cases. The experiments made in France on boilers provided with Serve tubes made of brass showed an advantage of about 20 per cent in their favor. The apparent advantages of these tubes will probably be offset to some extent by their increased cost as compared with the ordinary tubes, and by the greater difficulty of cleaning dust and soot from them.

A special report of the 22d annual convention of the American Society of Mechanical Engineers.

An account of the business meeting and an abstract of papers read.

JANUARY, 1891. Graphic statics and its application to construction pumps and pumping machinery. J. K. B.

THE STEAMSHIP.

OCTOBER, 1890. Adiabatic expansion.

A deduction of the principal formulæ used in working out questions in adiabatic expansion.

The proposed Canadian ship railway.

A method of connecting Lake Huron and Lake Ontario at Toronto by a ship railway, thus shortening about 400 miles of lake navigation between the head of the lakes and Montreal.

The dynamics involved in the lines and speeds of ships. Improved automatic boat-detaching apparatus. The application of electricity to welding. The dangers of coal cargoes.

A paper read before the Royal United Service Institution on the spontaneous combustion and explosions in coal-bunkers, with suggestions which would tend to minimise the risk of spontaneous ignition.

NOVEMBER. The development of the marine engine.

A paper by Prof. Seaton before the Iron and Steel Institute of America, in which was made a complete survey of the progress in marine engineering during the past fifteen years.

The Serve patent ribbed boiler-tube.

JANUARY 1, 1891. The theory of propulsion and centrifugal-force propellers.

An abstract of paper read before the Institute of Marine Engineers by Mr. Thos. Drewry.

Increased boiler pressures and increased piston speeds.

J. K. B.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.

VOLUME XVIII, 1890. Notes on the manufacture of open-hearth bridge steel. Concentration of low-grade ores. Notes on coals of Western Canada. Electrical accumulators or storage batteries.

The peculiar working of a blast furnace. Notes on American cannel coal. Aluminium in the drawing press. Aluminium bronze as a suitable material for propellers. On the use of aluminium in the construction of instruments of precision. Some tests of the relative strength of nitro-glycerine and other explosives. The properties of aluminium. Notes on fuel gas. The Herault process of smelting aluminium alloys. Phosphorus in pig-iron. Steel and iron ores.

J. K. B.

TRANSACTIONS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

VOLUME XI. The use of tables of the properties of steam in engine experiments. Cost of steam and water power. Cost of lubricating car-journals. The philosophy of the multi-cylinder or compound engine. Flow of steam through orifices. An experimental study of the errors of different types of calorimeters. Rolling steel rails. A new recording pressure-gauge. How to use steam expansively. Graphic analysis of reciprocating motion. Comparison of indicators. On the influence of steam-jackets. On the performance of a double screw ferry-boat. The theory and design of chimneys. Report of the committee on standard tests. Report of the committee on standard method of conducting daily trials of pumping engines. Tests of several types of engines as found in practice. The mechanical theory of chimney-draught. Notes on kerosene in steam boilers. The length of an indicator card. The effective area of screws. Steam-engine governor.

J. K. B.

JOURNAL OF THE AMERICAN SOCIETY OF NAVAL ENGINEERS.

NOVEMBER, 1890. Graphic method for determining and counterbalancing the centrifugal action of the connecting rod. Ericsson compound engine and Belleville boiler.

Experiments made at the Delamater Iron Works in New York by Chief Engineer Isherwood, on a non-condensing, single-acting, compound steam engine designed by John Ericsson, and on the Belleville boiler supplying it with steam.

New forms of evaporators. Notes on analysis of engine trials. The contract trial of the Philadelphia. The contract trial of the San Francisco. A continuation of the discussion on tubular boilers.

J. K. B.

TRANSACTIONS OF THE NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

VOLUME VI, 1890. Notes on the surveying and classification of shipping. The construction of marine boilers with a view to the use of higher pressure. High-speed engines for cargo boats. Boiler furnaces. Marine engines and boilers. Report of the council on the horse-power of marine engines. The weight of machinery in the mercantile marine. J. K. B.

PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS.

VOLUME CII, 1890. The application of electricity to welding, stamping, and other cognate purposes, by Sir F. Bramwell. The screw propeller, by S. W. Barnaby. Some applications of electricity in engineering workshops, by C. F. Jenkin. Experiments made with boiler-plate materials at the Royal College, Berlin. A new modification of the open-hearth steel process. J. K. B.

REVUE DU CERCLE MILITAIRE.

SEPTEMBER 21, 1890. The Annamite language and French influence in Indo-China. Fortifications of the St. Gothard, with maps and photographic views (continued). The latest improvements in the European navies.

SEPTEMBER 28. Notes upon the English army: I. The question of armament. Fortifications of the St. Gothard (ended).

OCTOBER 5. French influence in Indo-China. The latest improvements in the European navies (continued). Manœuvres of the IX German Army Corps.

OCTOBER 12. The grand manœuvres in Switzerland. The latest improvements in the European navies (continued).

OCTOBER 19. Military short-hand writing. The German manœuvres in Silesia. The latest improvements in the European navies (continued).

OCTOBER 26. Notes upon the English army: II. England's offensive power. Success of the Creusot plates in the United States.

NOVEMBER 9. A critic study of the great German manœuvres. The latest improvements in the European navies (continued).

NOVEMBER 16. The Austrian manœuvres in Hungary. The latest improvements in the European navies (continued).

NOVEMBER 23. A visit to the military exhibit in London.

NOVEMBER 30. The latest improvements in the European navies (continued).

DECEMBER 7. A visit to the London military exhibition: notes and impressions (continued). The latest improvements in the European navies (continued).

DECEMBER 14. A visit to the London military exhibition: notes and impressions (ended).

DECEMBER 21. French influence in Indo-China (continued). The latest improvements in the European navies (continued).

DECEMBER 28. French influence in Indo-China (ended).

JANUARY 4, 1891. Training of the foot-soldier in firing on the battlefield (continued in the next numbers).

JANUARY 18. The latest improvements in the European navies (continued).

In view of the interest it presents to naval people, this study is deserving of more than a passing notice. J. L.

REVUE MARITIME ET COLONIALE.

SEPTEMBER, 1890. The Italian navy appropriations 1890–91. Historical studies of the military marine of France (continued). The last operations and ruin of the fleet of Louis XIV. Approximate solution of the problem of ballistics for marine guns. The war navies of antiquity and mediæval age (2d part). Studies of comparative naval architecture (continued). Definitive trials of the Peral, Spanish navy.

NOVEMBER. The sea-fisheries in Algeria and Tunis. Notes on the formation of incrustation in marine boilers. The war navies of antiquity and mediæval age (see previous number). Naval discussions in regard to the English manœuvres of 1889.

DECEMBER. Elementary explanation of the influence of the earth's rotation upon the Fleuriai's gyroscope. The sea-fisheries in Algeria and Tunisia (ended). The war navies of antiquity and mediæval age. Experiments made at Meppen with a plunging fire against ships. J. L.

TRANSACTIONS OF CANADIAN SOCIETY OF CIVIL ENGINEERS.

VOLUME IV, PART I, JANUARY–JUNE, 1890. Discussion on Vancouver water-works columns, by C. F. Findlay. Generation, distribution and measurement of electricity for light and power, by A. J. Lawson, with discussion.

Introduction: Brief history of the development of dynamo electric machines for domestic lighting purposes. Showing growth in arc and incandescent lighting in America. Electric lighting in Canada, engines, boilers, arc lighting systems, wiring, dynamos, with illustrations. Brush, Thomson-Houston, Westinghouse, Edison, Royal Electric Co.'s A. C. Dynamo. Converters, meters: Edison's, Avon, Shallenberger. Storage batteries. Private installation. Measuring instruments. Electric railways. Street wiring.

THE UNITED SERVICE GAZETTE.

OCTOBER 4, 1890.

"During the trial of smokeless powder with various types of ordnance, which took place during the German manœuvres, it was found that steel guns were injured to a much greater extent by erosion of the bore than bronze guns. A proposal has been made to use aluminum bronze for small guns and also for liners of heavy guns. This is very likely to be soon tried practically, as Dr. Anderson, the Director-General of Ordnance, thinks that aluminum bronze might prove valuable for lining guns."

Naval training. Australasian defense.

OCTOBER 11. Control of artillery fire in action. Naval training, II.

OCTOBER 18. Automobile torpedoes. Important artillery experiments.

"Some important experiments were made at Silloth, the artillery range of Sir W. G. Armstrong, Mitchell & Co. The trial was that of a 6-inch quick-firing gun of 40 calibers length, on a mounting of new design. Another feature of this trial was the use of cordite, the new smokeless gunpowder. A velocity of 2669 f. s. was attained with a charge of cordite, with a chamber pressure under 20 tons. Comparative tests for rapidity of firing were made with cordite and with non-smokeless powders, at targets distant respectively 900, 1400 and 1800 yards, the results showing the advantage of the smokeless powder. A new quick-firing gun of 2.65 inches caliber (throwing a 10-pound projectile) was also submitted to a successful trial."

Chief petty officers. Recruiting.

OCTOBER 25. Our first line of defense.

NOVEMBER 1.

"During the recent manœuvres of the Italian fleet in the Mediterranean, some very successful experiments were made in the employment of carrier pigeons for communicating with the mainland. Although the pigeons came from the station at Piacenza, and had to fly a considerable distance inland after reaching the coast, very few of the birds failed to return to their lofts. On arrival at Piacenza the despatches were deciphered and their contents telegraphed to the various signalling stations along the coast. Some carrier pigeons from the station at Ancona were also sent to the headquarters of the army at Montechiaro for employment during the army manœuvres. These birds, after returning to Ancona (190 miles), were sent on over the Apennines to Rome, a further distance of 125 miles, and were found on the average to cover the whole distance in ten hours, notwithstanding occasional spells of bad weather."

Steam reserve officers.

NOVEMBER 8. Notes on the Aldershot auxiliary musketry school. Captive balloons. Three new French first-class ironclads. The protection of ships' crews.

NOVEMBER 15. Loss of the Serpent. Mounted infantry. Naval notes.

"An important trial of armor-plates has just been concluded at the Government ranges near St. Petersburg. Five shots at each range were fired from a 35-caliber 6-inch 6-ton gun with Russian Holtzer shell, weighing 91 pounds, at 350 feet; first, two rounds with 53 pounds of powder, giving an initial velocity of 2000 feet, and then three with 53 pounds and a velocity of 2100 feet. There were three plates of 10 inches each, submitted by Messrs. Brown & Co., Messrs. Schneider, and Messrs. Vickers. The first of these, a compound plate, resisted the first two rounds, the shell remaining embedded in the armor, but the last three went clean through it. The Schneider hard-steel plate broke up three shells, and only the third penetrated as far as the backing, but the plate suffered severely, showing cracks in all corners. The Vickers plate, of softer steel, was more deeply penetrated by the shells; none of which, however, got right through, while the cracks were comparatively insignificant."

Notes on Aldershot musketry school, II.

NOVEMBER 22. Entry and training of naval officers. Loss of the Serpent. The magazine rifle. Protection of ships' crews, II.

NOVEMBER 29. Practice at balloons, I. Launch of the Edgar.

The Edgar is one of the first-class protected cruisers which are being built under the Naval Defense Act. There are eight similar vessels under construction. They are of 7350 tons displacement, 360 feet long, 60 feet beam, and draw 23 feet 9 inches of water. Their engines to indicate 12,000 H. P. with forced draft, 7500 H. P. with natural draft, giving speeds of 20 and 18 knots respectively. Coal capacity, 850 tons. Armament, two 9-inch 22-ton B. L. rifles, ten 6-inch quick-firing rifles, sixteen 6-pounder R. F. guns, three 3-pounder and eight machine-guns. Two above-water and two submerged torpedo-tubes. Protective deck, greatest thickness five inches. A 6-inch steel armor protects the machinery above the water-line. The Edgar has vertical engines and twin screws.

Yarrow torpedo-boat Bathurst.

DECEMBER 6. Launch of the Naiad. Protection of our commerce. Trial trips of the Bellona and the Spezzia. Trials with armor-piercing projectiles.

DECEMBER 13. Fiske's range-finder. The phonograph and its adaptation to military uses. Education and training of naval officers. Practice at balloons, II. Aerial locomotion. Protection of commerce. Engine-room lieutenants. The Russian Imperial yacht Polar Star.

DECEMBER 20. Launch of the Pique and the Thetis. The Serpent court-martial. Army and navy convalescent and training home. Naval notes. Steel cruisers. The magazine rifle, II. Navigation in the navy. Defense expenditure of the chief powers.

DECEMBER 27. Army organization in India. The naval manœuvres of 1890. The Serpent court-martial. The magazine rifle, III. Naval notes. New armament and engines for the Thunderer. The official trials of the Spanish ironclad Pelayo, with respect to the behavior of Vavasseur-Canet carriages. Experiments on gun-steel at low temperatures.

JANUARY 3, 1891. Naval notes: Launch of the Capitan Prat (Chilian armor-clad); Launch of the Sybille; Estimates for the French navy for 1891; Forced draft; The army in 1890; Naval retrospect, 1890.

JANUARY 10. The development of modern cavalry action. The "Tortoise" wagon-tent. The Vitu expedition. Foreign naval progress and construction during 1890, I. Training naval stokers (with discussion).

JANUARY 17. Steel as applied to armor plates. Yarrow's tubulous boilers. Coaling ships at sea. Foreign naval progress and construction during 1890, II.

JANUARY 24. Promotion from the ranks in the navy. Boat-hoisting machinery trials.

JANUARY 31. The recruiting difficulty. Liquid fuel.

H. G. D.

LE YACHT.

SEPTEMBER 20, 1890. The mercantile American school-ship Saratoga. Naval technical association: reciprocal actions of rudder and screw (A. Normand).

SEPTEMBER 27. Trial of the Creusot plates in the United States. Trial of the Japanese cruiser Itsuku-Shima.

OCTOBER 4. Three new French armored ships. Something about the cruiser Le Cécile, of the French navy.

OCTOBER 11. A comment on the German naval manœuvres. Italian naval estimates for 1891. Mercantile naval schools.

OCTOBER 18. The Creusot and Cammell plates' trials at Annapolis.

OCTOBER 25. Mercantile naval schools (continued). Trials of the third-class cruiser Surcouf, of the French navy.

NOVEMBER 1. The yacht-club of France and the America's cup. Launching of the armored cruiser Dupuy-de-Lôme. The new Japanese guard-ships (Itsuku-Shima type).

NOVEMBER 8. More about the mercantile naval schools. The European boards of admiralty.

NOVEMBER 22. Discussion of the navy budget.

NOVEMBER 29. The navy. The squadron of evolution and the torpedo-boats. The committee of thirty-three.

DECEMBER 6. Armored battle-ships of great displacement. English cruisers and their armament; the weight and position of the guns criticised. Chemical preparation of sea-water for feeding marine boilers.

DECEMBER 13. Rules governing promotion in the European navies. A comparison between the national (French) and foreign torpedo-boats.

DECEMBER 20. Qualities indispensable to a life-boat. A comparison between the French and foreign torpedo-boats (continued).

DECEMBER 27. Government and private dock-yards. A propeller with plane and removable blades, system Margue.

JANUARY 3, 1891. A review of the navies of the world, by E. Weyl. Engines for multiple screws.

JANUARY 10. The second-class cruisers, by E. Weyl. Board of the French Yacht; institution of the "Cup of France"; opening of a public subscription. Qualities required in a life-boat.

JANUARY 17. National navy: the committee of thirty-three. The Newfoundland fisheries. The 110-ton gun of the Sans-Pareil (E. W.). Lieut. Fiske new telemeter. J. L.

REVISTA MARITIMA BRAZILEIRA.

AUGUST, 1890. Co-operative military. Great ranges of modern artillery. The defenses of Bahia. The Peral. A new gun-mounting (with plate). Notes on naval architecture. Floating dock. Pyrodynamics. Naval notes.

SEPTEMBER AND OCTOBER. The schistofone. Pyrodynamics. The infancy of nautical science. Notes on naval architecture. Various notes.

REVISTA MILITAR DE CHILE.

No. 48, SEPTEMBER, 1890. Don Federico Errázuriz Echáurren. The Chilian commission to Peru. Establishment of permanent staff. Visit to the Krupp gun foundry (concluded). Instructions for target-firing (continued). Canet guns and Chilian republic. Garrison and interior service (continued). The Giffard rifle. Subsistence for the soldier (continued).

No. 49, OCTOBER. The artillery of our new cruisers. The Chilian army. Garrison and interior service (continued). A new rifle. Desertion in the field or in time of peace. Subsistence for the soldier.

No. 50, NOVEMBER. What constitutes the reserve of our army? Lieut.-Colonel Don Severo Amengual. Marksman's manual. Military legislation of Spain. Ballistics of the Giffard rifle. Instructions for target-firing. Subsistence for the soldier (continued).

No. 51, DECEMBER. General Baquedano. Laws for promotion. Desertions in time of peace. Records of a commission on the Chilian campaigns. On the enlistments in the army corps. Military legislation of Germany. Competitive firing-tests between Krupp and De Bange, at Batuco. Instructions for target-firing.

REVISTA DE LA UNION MILITAR.

No. 8, AUGUST, 1890. The army. The National Guard. Armies of the Independence. Experiments with artillery fire. Tactics of firing with magazine rifles.

No. 9, SEPTEMBER AND OCTOBER. The army: military discipline and subordination. Tactics of firing with magazine rifles (continued). Infantry engagements and open order. Argentine valor. Resistance of air. Information on the manufacture of powder.

H. G. D.

RIVISTA DI ARTIGLIERIA E GENIO.

OCTOBER, 1890. Upon the rigorous solution of the problem of balli-tics, by F. Siacci. Description of the barracks of Passalacqua in Novara. The fortifications on the northeast frontier of France. The Monier system of building in iron and cement.

NOVEMBER. The fortifications on the northeast frontier of France (concluded). The importance of rapidity in artillery fire in action. On lightning conductors. Supplement to the manual of the laboratory of precision.

DECEMBER. Ammunition supply to field artillery. Firing with time-fuzes. Some notes on military stables. An electric cell with circulating fluids.

RIVISTA MARITTIMA.

OCTOBER, 1890. Study on modern naval tactics, by Lieut. G. Ronca (continued). Fire-ships and infernal machines in naval warfare (historical), by Lieut. Ettore Bravetta (continued). River steam navigation for transporting the wounded in time of war, by F. Santini and F. Home-Rosemberg. A month in the island of Ceylon (continued).

NOVEMBER, 1890. The launch of the Sardegna, by I. Sigismondi. Study on modern naval tactics, by Lieut. G. Ronca (continued). Fire-ships and infernal machines in naval warfare (historical), by Lieut. Ettore Bravetta (continued). On the use of fresh water on board the royal vessels, by N. Soliani.

Gives full description of the distillers of Normandy and Kirkaldy types, with cuts of same.

Ships and guns.

DECEMBER, 1890. Fragments of naval architecture, by Guiseppa Rota.

The author gives experiments on the resistance of ship's under-water body, with system adopted to graphically represent the results. Elements of resistance and propulsion of a vessel when the displacement and draft forward and aft are changed, within fixed limits.

The German merchant marine, by Salvatore Raineri. Electric search-light projectors, by L. Pasqualini. The interior of Africa, by Ettore Bravetta. Study on modern naval tactics, by Lieut. G. Ronca (continued).

JANUARY, 1891. Study on modern naval tactics, by Lieut. G. Ronca (continued). The German merchant marine, by Salvatore Raineri (continued). Electrical units, by Lieut. A. Pouchain. The interior of Africa, by Lieut. Ettore Bravetta (continued). Upon the origin of meteorological observations and instruments, by G. Hellman, translated by A. Cancani. New engines for the Sirio, Orione, and Perseo. H. G. D.

REVISTA TECNOLOGICO INDUSTRIAL.

SEPTEMBER, 1890. Transportation and refining of petroleum (continued). Theory of the steam engine (continued).

OCTOBER. Theory of the steam engine (concluded). History of mills. Agricultural plantations.

JOURNAL OF THE UNITED STATES CAVALRY ASSOCIATION.

VOLUME III, SEPTEMBER, 1890, NO. 10. With the reserve brigade (second paper), by Captain Moses Harris. Troop and company pack-trains, by Lieutenant A. A. Cabaniss. A reconnais-

sance with the first Maine cavalry (with map), by Brevet Maj.-Genl. C. H. Smith. Kilpatrick's raid around Atlanta, August 18th to 22d, 1864 (with map), by Lieutenant W. S. Scott. A new lecture on the horse's foot (with illustrations), by Lieutenant H. J. Goldman. An unexampled ride, from the Pacific to the Baltic on a single horse, by A. N. Kovrigin. New drill regulations for cavalry, United States army; evolutions of the regiment; ceremonies. Professional notes. Book notices and exchanges.

MILITÄR-WOCHENBLATT.

DECEMBER 24, 1890. The French cruiser Cécile. Launch of the Dupuy-de-Lôme.

DECEMBER 31. Trial trips of the French cruiser Surcouf. Gun for throwing lines.

JANUARY 3, 1891. Flight of carrier pigeons in France. Italy's squadrons. Trial with unforged cast-steel gun-tubes in Sweden.

JANUARY 7. A new magazine rifle for the Danish troops. The Giffard rifle. Captive balloon on board the Formidable.

JANUARY 10. New armored vessels for Japan. New American magazine rifle.

JANUARY 14. Bayonet exercises. Firing tests from armored turrets at Creusot.

JANUARY 17. The magazine rifle in England. Launch of the Edgar. Inquiry into the loss of the Italian torpedo-boat 105 S.

JANUARY 21. Armor tests in Russia.

"Three plates were tested at these trials, held at Ochta, Nov. 11, 1890; viz. a Brown compound, a Schneider steel, and a Vickers mild steel plate. More recent tests were held at Kolpino with compound plates of Wilson's patent, which stood the tests successfully. . . .

"Tests like those of Ochta and Annapolis are scarcely decisive, because it is improbable that deliberate firing at armor, with guns of medium caliber, at short range and with perpendicular impact, will ever occur in action. The deciding point in the struggle of guns against armor during action will be the penetration of the target by a few heavy-caliber projectiles, hitting at greater or less angle with the normal.

"The value of the above tests lies more in giving a comparison of plates and guns than in any tactical importance. And in this regard the important results stand forth that the compound plates of the English firm of Cammel & Co. have been beaten by those of Schneider et Cie. of Creusot, as well as by those of the Government works in Russia; another example, particularly in questions pertaining to war, that inactivity is equivalent to retrogression, more apparent to-day than ever. And it must be acknowledged that Russia's efforts, though owing to the use of foreign improvements, deserve the highest appreciation, in regard to their armor-plates as well as their projectiles, the latter behaving as well as the real Holtzers. Russia will prove a formidable opponent, and require every effort in order to cope with her on an equal footing."

JANUARY 28. New men-of-war for the Argentine Republic.

JANUARY 31. Firing tests on the island of Fanö, Denmark.

FEBRUARY 4. Wolfram's projectiles. Use of electric power in French fleets.

SUPPLEMENT TO MILITÄR WOCHENBLATT.

Nos. 1 and 2, 1891. The battle of Mount Valérien, January 19, 1871, by Major Kunz. Strategic views of the question of fortifications, by Major Scheibert.

No. 3. Plans of attack and defense of Frederick the Great in the first two Silesian wars, by A. v. Roesgler. H. G. D.

JOURNAL OF THE ROYAL UNITED SERVICE INSTITUTION.

VOLUME XXXIV, No. 154. The transport of the sick and wounded in time of war. The employment of large masses of cavalry, of movable fortifications, and of smokeless powder, as illustrated by German autumn manœuvres of 1889. Spontaneous ignition and explosion in coal-bunkers. Notes: Gruson experiments with smokeless powder C/89. Armed strength of Russia.

VOLUME XXXV, No. 155. The entry and training of naval officers, by Rear-Admiral N. Bowden-Smith.

The consensus of opinion in England seems from this discussion to be in favor of gaining a working knowledge of the naval profession at sea in actual service before a professional education, properly speaking, is undertaken. That to come afterwards, though just how, is not exactly pointed out. The idea seems to be that being an officer and a gentleman he will see the value of an education, and in some way acquire it. The question of additional mental training would seem to be subordinated to the necessity of becoming at an early age accustomed to the "unnatural life" of a seafaring man. Our system of giving a professional education, combined with enough practice to illustrate, before the actual service at sea begins, seems to be more in consonance with the course pursued in acquiring other professions.

Translations: Belleville boilers and their applicability to ocean-going vessels. Cruiser-war and coast-defense. Considerations on the employment of torpedo-boats. Tactics and vertical fire.

SCHOOL OF MINES QUARTERLY.

NOVEMBER, 1890. Theory of stress in a granular mass. Outbursts of gas in metalliferous mines. Examination of mines. Graphical method of showing the relative annual efficiency of a steam plant. Wind-problem in gunnery, Part II.

JOURNAL OF THE MILITARY SERVICE INSTITUTION.

JANUARY, 1891. A practical scheme for training the regular army in field duties for war (prize essay). A proposed change in artillery school methods. Modern Bobadilism in the marksman's method of defeating an army. Strategy, tactics and policy. The gyroscope and drift education of the soldier.

PROCEEDINGS OF THE ROYAL ARTILLERY INSTITUTION, WOOLWICH.

OCTOBER, 1890. Ranging and range-finding. Horse artillery progress abroad. Battle of Dettingen. Practice at a moving target from a low site.

NOVEMBER. Ranging a battery.

DECEMBER. Instructions for practice over sea-ranges.

JANUARY, 1891. Changes in the Royal Artillery. The origin of our present drill-book.

UNITED SERVICE.

JANUARY, 1891. Wellington. The Harriet Lane. Modern armor.

FEBRUARY. The influences of small-caliber magazine rifles and smokeless powder on tactics. Moltke, Part I. The history of the U. S. Marine Corps. C. M. K.

AMERICAN CHEMICAL JOURNAL.

VOLUME XII, No. 8, NOVEMBER, 1890. The acquisition of atmospheric nitrogen by plants, by W. O. Atwater and C. D. Woods. Reviews and reports: A short account of hydrazoic acid, recently discovered by Curtuis, who will be remembered as the discoverer of hydrazine.

Hydrazoic acid is a gas of the formula HN_3, of a fearfully penetrating odor; soluble in water, the solution resembling hydrochloric acid; the salts are well defined; the silver salt AgN_3 having very violent explosive properties.

VOLUME XIII, No. 1, JANUARY, 1891. Atwater and Woods conclude their work on the acquisition of atmospheric nitrogen by plants. C. R. S.

REVIEWERS AND TRANSLATORS.

Lieut.-Commander C. S. SPERRY,
P. A. Engineer J. K. BARTON,
Ensign H. G. DRESEL,
Ensign C. M. KNEPPER,
Prof. C. R. SANGER,
Prof. J. LEROUX.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1892.

A prize of one hundred dollars, with a gold medal, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the Prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1892. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

5. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

6. All essays submitted must be either type-written or copied in a clear and legible hand.

7. The successful competitor will be made a Life Member of the Institute.

8. In the event of the Prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of a gold medal.

By direction of Board of Control.

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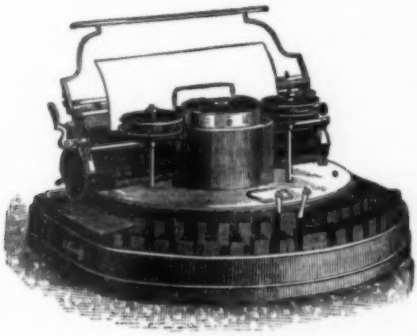

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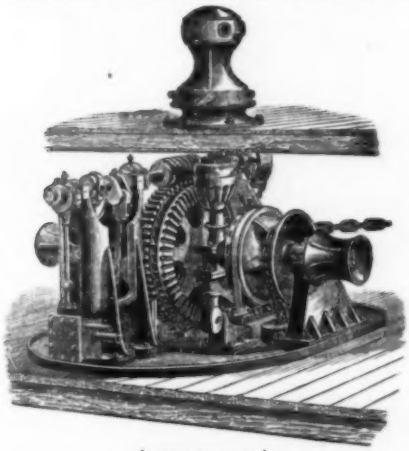

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